

## **Ecological hyper-architecture and the ambiguity of its value**

*The environmental movement of the 1960s and 1970s was constituted in part by ecologically conscious architecture. The value of architectural design was considered in relation to actions that support the recovery of endangered ecosystems and the future survival of the human species. Contemporary hyper-architecture, which incorporates formal and performative principles through the use of computation and indexing, no longer directs ecological awareness exclusively to moral decision-making. Rather, this awareness is incorporated into a way of thinking that recognizes the pervasive issues of ecology, environment, and the use of resources but as generative potential for the design of architecture itself. One consequence of the emergence of ecological hyper-architectures is the need for a discourse that explores the problem of values that occurs between the realm of ethics and the realm of architectural production.*

### **Introduction**

In recent years, a number of architecture and urbanism books and magazines have presented projects that express eco-morphological and bio-aesthetic tendencies.<sup>1</sup> The conception of these projects relies heavily on computer-aided design tools. Since the 1990s, the prefix “hyper-” has increasingly been associated with architectural production in the digital realm. Conceptually, “hyper-” refers to architecture that either evolves from advanced digital modeling techniques or incorporates specific technological features – or combines both in its conceptual approach. Part of this evolution is the talk of a new architecture “in which, thanks to the progress of information technology, science and nature can work together.”<sup>2</sup> A review of design methods, architectural projects, and related arguments raises certain questions: What is the motivation for this kind of collaboration? What is the value of an ecological approach to architecture? Does it contribute to moral principles, or does it contribute to self-referential architectural discourses and the search for variations in architectural representation? These questions are addressed in three interrelated sections. The first deals with the meaning of the term “ecology” in the context of this study. The second section deals with the discourse of ecological hyper-architecture in terms of its techniques of emergence. The final section addresses the problem of values in relation to ecological hyper-architectures.

### **I. The meaning of ecology**

When we talk about a particular variety of hyper-architecture called “ecological”, it becomes necessary to determine how to treat ecology in the context of this discussion. Basically, the term “ecology” cannot be reflected by the image of a pristine landscape or well-protected nature. Rather, it is associated with the thinking about systems. Ecology is about relationships: the relationships between organisms and their environments, which become ecosystems. In this sense, these relationships are sometimes described as “networks of internal and external flows that operate at multiple organizational scales or orders.”<sup>3</sup> To further recognize ecology's connection to hyper-architecture, we must also locate ecology within concepts of economy and morphology. The German

biologist and philosopher Ernst Haeckel “first coined the term ‘ecology’” in 1866.<sup>4</sup> He defined ecology as “the whole science of the relations of the organisms to the environment including, in the broad sense, all the conditions of existence. These are partly organic, partly inorganic in nature; both [...] are of the greatest significance for the form of organisms, for they force them to become adapted.”<sup>5</sup> Haeckel's writings indicate that his concept of ecology emerged in the context of morphology, the discipline that studies the continuous variation of forms as affected by forces, “structures, homologies and metamorphoses.”<sup>6</sup>

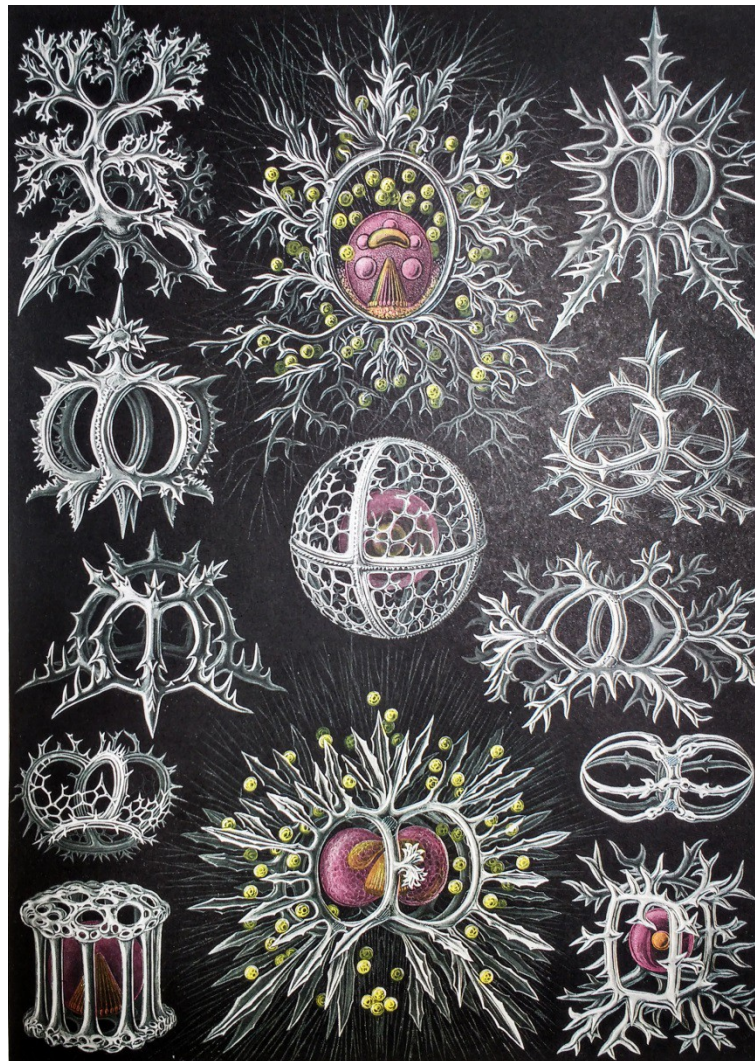


Fig. 1. Ernst Haeckel, illustrations presented in his work *Kunstformen der Natur*.

On the one hand, “ecology” and “economy” share the same etymological background. They derive from the Greek word *oikos*, which means household or economic community. On the other hand, Haeckel made it clear that what was meant by ecology was a “body of knowledge concerning the economy of nature.”<sup>7</sup> However, its economic aspects also made it easy for the capitalist system to incorporate applied ecology into its cosmos; making “ecology the means for managing the integration and expansion of [...] human economy into non-human economies.”<sup>8</sup> When one of these

economies suffers disadvantages in the course of these processes, or when biological systems are no longer able to subsist and lose productivity, we speak of unsustainable developments.

Consequently, the approach to ecology leads us to the metropolis as an urban condition of life that has emerged in the capitalist system. The metropolis has become the fundamental habitat of man. It is conditioned by flow, exchange, growth, and the manifestation of economic power while the metropolis itself in turn produces these conditions. The metropolis is both, “the primary space ‘in’ which exchange happens” as well as the factor that “designates the general processes by which *space itself* is formed or produced by exchange.”<sup>9</sup> However, urbanity does not necessarily require the physicality of the city to develop. Essentially, urbanity is defined by the quality of the distribution networks of labor, goods, cultural products, and information. Yet we are witnessing an increasing number of people seeking access to these networks through cities or metropolitan areas.



Fig. 2. The metropolitan area of Seoul, South Korea.

Reflecting on ecological hyper-architecture leads us to a type of architecture that is substantially informed by the urban condition. If we are looking for a definition of ecological hyper-architecture, we can suggest the following:

1. Ecological hyper-architecture emerges extrinsically from forces that are set in motion by the urban condition.
2. It advocates strategies for the incorporation of architectural, technical, and biological systems that intentionally or presumably contribute to beneficial living environments in urbanized areas.

3. It incorporates new production sites for the extraction and production of commodities that may be scarce but are always demanded by the urban condition.

## II. The emergence of ecological hyper-architecture

The establishment of relationships between the systemic aspects of the urban condition and the design of ecological hyper-architectures is the subject of advanced computation. The digitally enhanced simulation of forces, growth and metamorphosis has become a primary driving force in the recent development of hyper-architectures. In the 1990s, the architectural discourse was strongly dominated by architectural works that relied heavily on a conceptual juxtaposition between dynamic computer-aided design tools and of scientific works in the field of morphology such as D'Arcy Wentworth Thompson's book *On Growth and Form*. This relationship provoked a controversy that continued into the new millennium. While rejecting type, symmetry, preconceived forms, and the recourse to past architectural styles, the post-postmodernists of architecture turned to scientific contexts in order to legitimize their maneuvers in the digital realm and to emphasize the usefulness of these design tools for innovation within the discipline of architecture. It was a discourse that revolved largely around the question of form and architectural representation.

The digitally induced indexing of forces such as the flow of people, traffic, matter and information was initially assigned to the manipulation of form. The use of computer software in the architectural practice made it possible to dynamically render mathematical models of forces and morphological phenomena and to produce graphic representations of these models. In recent years, indexicality has continued to be a topic of architectural discourse. Indexicality refers to the diagrammatic or descriptive character of geometries. Vectors, for instance, are a well-known example of such geometries. They are characterized by their connection to the matter they describe. "They describe flows, effects, and atmospheres that are close to their own constitution. [...] [T]hey are literally tied to the body they describe both in space and time, moving as it moves."<sup>10</sup>

It seems that indexicality is also directly connected to the problem of how values are defined in the context of ecological hyper-architecture. In a conversation with architectural theorist Sanford Kwinter, architect and designer Jason Payne has mentioned two ways of indexical practice in architectural design.

1. The first way is "orientated toward appearances". It "is concerned with indexing purely as image,"<sup>11</sup> while "displaying the indexing motif has become an end in itself."<sup>12</sup>
2. The second way, on the other hand, uses indexing "to produce distinct effects, [...] to connect two different systems, etc."<sup>13</sup>

According to Payne, the first path largely misses critical claims because it turns unconditionally to indexical methods for the sake of representation and diversity of architectural form. Whereas the second path follows a "pragmatic indexicality", which is characterized by the prudent use of indexical methods.<sup>14</sup>



Payne somehow speaks of the two modes of the indexical method as of two initial paths. However, this comparison overlooks the fact that design techniques are also subject to change in terms of their development, how they are used, and the intended goal of their use. In this way, their meaning also potentially shifts – for the designers who use them as well as for the outcome of the project to which they are assigned. Between 2004 and 2008 the architects and scholars Archim Menges and Michael Hensel co-edited three issues of the journal *Architectural Design* (No. 3, 2004; No. 2, 2006; No. 2, 2008) on the topic of so-called morphogenetic design strategies.



Fig. 3. *Architectural Design* magazine. Issues No. 3, 2004; No. 2, 2006; No. 2, 2008.

For example, these strategies reintroduce nature as a generative potential while attempting to instrumentalize natural processes of evolution, growth, and metabolism as design tools. The headlines on the covers of the successive issues might suggest something like a chronological development of these strategies and their use. Accordingly, one end of the line is defined by morphogenetic design operations, largely devoted to finding and producing exotic forms in architecture. The other end is defined by morpho-ecological design strategies, which are concerned with systemic contexts to which architecture contributes through its performance and adaptability. What this sequence of articles reveals, in fact, is a permanent shift between ways of using a specific design method, as well as strategies for combining formal and performative approaches in the use of design methods.

In Payne's evaluation, a difference or shift in values is established through a critical stance that emphasizes the performative capacities of architecture and its elements. At this point, this stance represents a preference for a particular approach to design actions in architectural practice. It does not, however, necessarily entail moral implications or values in the sense of an ethical concept or advice that can be conceived, for example, in relation to ecological awareness. Morphogenetic design strategies and indexical practice constitute a good part of the generative methods in the genesis of ecological hyper-architectures. But what does thoughtful action mean in the context of

ecological hyper-architectural production? How does it evoke shifts in the meaning of the ecological approach to architecture, its discourse, and its cultural implications?

### III. Discussing ecological hyper-architecture in terms of values

From a historical perspective, the 1960s and 1970s witnessed a growing concern in Western societies about the limited capacity of the earth, the staggering problems caused by the reckless exploitation of natural resources, and the possible collapse of the ecosystem, which led to the development of the environmental movement of that period. This movement was co-constituted by, among others, by an architectural profession that expressed ecological awareness and that saw in architecture a role as a counterbalance to consumerism and aesthetic economy. On the one hand, this environmentalist counterculture was accompanied by a critical attitude towards technology. The rejection of technology was based in part on its allegedly broken promise to provide for the well-being of humankind and not just for the economic elite of the industrialized countries. On the other hand, it was again the concept of architecture as an efficient and adaptable machine that reflected ecological awareness. Architecture was to become an integrative force that, through its performance, ensures a balance in the use of resources. A prominent figure in this regard was Buckminster Fuller, who pursued the idea of resource-efficient environmental control through housing. The impact of ecological awareness on Fuller's work led to a series of unconventional designs (including single-family homes, large structures, and automobiles) that he sought to realize through the use of Fordist production methods and industrially manufactured materials. These concepts, which Fuller subsumed under the term *Dymaxion*, also reached the level of hyper-architectures, in the sense of ultra-large structures covering entire urban areas. For example, Fuller proposed the placement of a gigantic dome over downtown New York, combining the efficient construction of a geodesic structure with the idea of local environmental control, energy conservation, and pollution prevention.

The ecological consciousness of the environmentalist approach to architecture was characterized by a sense of socio-ecological obligation in relation to what the built environment was capable of doing. The value of architectural interventions was considered in relation to actions that supported the recovery of the endangered ecosystem. In contrast, contemporary architectural discourse-driven explanations refrain from directing “the new wave of ecological architecture”<sup>15</sup> exclusively to ethical issues; they do not seem to emphasize moral values in particular. Rather, they are absorbed in attitudes that promote a way of thinking in architecture that supposedly “critically recognises a recirculatory understanding of the world and its resources,”<sup>16</sup> of ecological cycles and natural processes, but as generative potentials. Ecological awareness and sustainability are not perceived as intrinsic architectural problems – unlike the constitution and synthesis of forms, tectonic language and syntax. Instead, they have entered the discipline of architecture (like so many other professions) from the outside. The consequence of this situation is that architects are constantly forced to move between the inside and the outside. On the one hand, they struggle to maintain the stability of the discipline, and, on the other hand, they have to manage the demands for “utilising architecture as an active tool for sociopolitical change.”<sup>17</sup>

This situation contributes to a specific systemic way of thinking about architecture. In systems theory, the outside or environment of a system can perturb a system. But how the system deals with the disturbance depends on the system itself and not on the nature of the disturbance. Now, proponents of the recent ecological architecture discourse have claimed that architects must stop moving between the schism of socio-ecological concerns on the one hand and architectonics on the other. Instead, ecological aspects must be transformed into an operational potential for the concerns of the architectural discipline itself. In this case it is not moral implications that continue to drive the ecologization of architecture. It is the acceptance of a situation in which, firstly, no part of the earth remains unaffected by entities such as global warming, and, secondly, science continues to change our notion of the environment and the image of our habitats through surveys, studies, and data.<sup>18</sup> Ecological issues are inescapable, as is their absorption into the self-referential architectural discourse. The value of the ecological approach in architecture has changed. For the generation of architects and designers who shared the ecological awareness of the environmental movement of the 1960s and 1970s, it was an asset in the effort to save the planet from destruction. A critical situation required certain actions. Under the premise of contemporary hyper-architecture, ecological awareness has gained value as an ever-present and all-encompassing theme, while this theme is used to negotiate the consolidation of architecture as a system that deals with problems in its own way. Approaching the ecological question through code and indexical practice is also a way of informing the genesis of the built environment. It has become a means of overcoming the artistic-subjectivist and scientific-objectivist dichotomies – in the sense of architectural expression and environmental science – within the discipline of architecture.

The attribution of sciences to architectural morphogenesis has earned architecture the criticism that it has been swallowed up by scientism. In contrast, proponents of experimental ecological hyper-architecture such as Françoise Roche claim that the reintroduction of nature and ecology contains the possibility of an imaginary science or for a (science) *fictional* architecture. “Fiction” here does hereby not refer to utopia; to an ideal situation of environmental preservation. Rather, it refers to scenarios. Scenarios are narratives that tell of situations, of places and actions, of movements and things. In the case of Roche’s work, “the scenario acts as creative and critical compost in which resources, materials, energies, sources, structures, territories, and species”<sup>19</sup> are locally organized as discrete elements into a new system. As they are assembled through procedures of scripting and reprogramming, the elements undergo displacements and shifts while the result of these assemblages is always subject to detours. This means that even when processes are set in motion to produce results, the outcome may be open-ended and unpredictable. This flexibility and volatility is not seen as a flaw, but as a contribution to the innovation of architecture. In this way, architecture transforms into heterogeneous ecological systems or becomes a strange machine.

Roche understands machinery as an asset for the local resistance to the globalized aesthetic economy and its international manifestation in architectural forms. The transformation of territories here and now, through the use of local resources and the reciprocal manipulation of the technical

and the natural, should generate an opposition to a built-in-stone-urbanism and its moral presuppositions and enduring values.<sup>20</sup> In this sense, the machine, or the notion of the machine, plays an essential role in the narrative approach, as Roche argues:

“Machines have been always pretending to do more than what they were programmed to do. It is their nature. Their behavior alternates phantasms, frustrations and fears inspired by their own ability to break free and threaten us. [...] The blurriness between what they are supposed to do, as perfect alienated and domesticated creatures, and the anthropomorphic psychology we intentionally project on them, creates a spectrum of potentiality, both interpretative and productive, which is able to re-‘scenarise’ the operating process of the architectural field. Machines are a vector of narration, generators of rumor, and at the same time directly operational, with an accurate efficiency of production.”<sup>21</sup>



Fig. 4. Francois Roche, Stéphanie Lavaux and Jean Navarro: Design of a private laboratory in Paris.

Roche's remarks are also a flirtation with the kind of paranoia that has haunted people since the machine age. It is a sense of fear that technologies remain untamable, that they – used essentially as means – establish forms of domination that are “all the more perverse for not imposing the law of a master but that of an emancipated slave who does not have the least idea about the moral goals proper to humankind.”<sup>22</sup> Beyond the whiff of paranoia, contemporary philosophy, such as object-oriented ontology, conceives of things, entities, and technologies as what they are: They produce



effects regardless of how we feel about them. In the philosophy of technology scholars such as Peter Paul Verbeek and Bruno Latour have argued that a good deal of moral affairs are co-constituted by technological objects and artifacts, as our lives are constantly intertwined with them.

Ecological awareness and its artistic and technical derivations have effectively gained value for the sake of architecture as a means of consolidating its systemic capacities (in the sense of dealing with external references in the manner of the architectural discipline) as well as for reforming the understanding of architecture itself. This means that ecology also confronts us with a specific ethos of the discipline. But what are the consequences if we return to question the moral value of contemporary ecological hyper-architecture? Thereby we must reconsider our understanding of the constitution of values in terms of subjectively and objectively determining facts of value.

In the first place, saving the “environment” carries objective facts of value that belong to the meaning of the “environment” itself for the habitability of the planet and the survival of the human species. In this sense, the environment has consequently become the object of action for environmentalists. The environmental movement constitutes an authority that has established values according to a value system that is oriented towards appropriate types of action that contribute to the preservation and recovery of the ecosystem. The preferences of individuals and groups begin to determine facts of value or transvaluate the values of others. Now, for the proponents of ecological hyper-architecture discourse, the value of ecological awareness does not belong to environmental activism, but to inherent aspects of the architectural discipline and to possible innovations of architecture. This point of view forces us to turn to the tangible things then, to the products of architectural practice and to the facts of value that belong to the same reality as the designed objects. Bruno Latour has stated that morality is a “heterogeneous institution constituted from a multiplicity of events,”<sup>23</sup> which consequently includes human and non-human entities, the natural and the technical alike. For Latour, technologies cannot simply reside in the form of means, since “a substantial part of our everyday morality rest[s] upon technological apparatuses.”<sup>24</sup> Latour has argued for a return of “ontological dignity” to technology and morality.<sup>25</sup> Thereby, technology and morality are conceived as forms of mediation, which then always have the power to transform, modify, detour, translate or displace entities, meanings and ends. In this sense, there is also always a discrepancy between what the designer meant or intended and that what the architecture offers and does as a designed object.

Even if architects refuse to adopt moral principles coming from an external authority, but instead enforce or transform the patterns of action of their discipline, their projects can still obtain moral values. The confrontation of architecture with environmental features, non-human entities and ecological cycles generates a series of influences that are dealt with through the development and mutation of architectural concepts. Thereby ecological consciousness initiates detours in the thinking of the designer and in the overall design process with the result that a number of aspects and factors enter architecture. We can identify some of these elements as:

- The optimization of structures and the reduction of material input.
- The introduction of natural homeostatic regulatory systems into the built environment for the purpose of a resource-efficient performance of architecture.
- Transforming pollution into a generative potential for the design of architecture and its intended performative capabilities and usefulness.
- Turning waste into an opportunity through upcycling concepts that extend ecological cycles by the reuse of materials.
- Inviting organisms, plants and animals to inhabit new territories and allowing them to exist in close proximity to human habitats.
- The introduction of technically enhanced built environments for the immediate production of food and goods in urban conditions and in close proximity to the consumers.

These are not issues of just any intended design. They are problems or moments that significantly shape actions and generative operations of a design process that leads to a concrete architectural outcome as the result of a transformation of the ecological consciousness that takes place through the matter of architecture. On the one hand, the work on hyper-ecologies implies a shift in the concerns that guide the architect's thinking and maneuvers. On the other hand, it consequently initiates a shift in terms of what the conceived architecture is supposed to do, how it generates effects, and how it relates to the other parts of an ecosystem. This also qualifies ecological hyper-architectures as moral agents that potentially impose their own power on the world.



Fig. 5. Vincent Callebaut Architectures: *Asian Cairns. Sustainable megaliths for rural urbanity.* 2013.

The question remains, however, whether the concepts and designs of ecological hyper-architecture can always ultimately contribute meaningfully to the stabilization and improvement of environmental conditions based on a true or scientific understanding of ecology. Likewise, it is questionable how the values inherent in ecological hyper-architecture are appreciated by others than a circle of architects, such as the various groups, economic actors, stakeholders, and authorities who are involved in the construction, realization and transformation of the built environment. Do the promises of ecological hyper-architecture find acceptance and how are they weighed against other facts of value? At the moment, we are beginning to see the implementation of so-called ecological architecture on a larger scale. Projects such as the *Bosco Verticale* residential towers in Milan, designed by Italian architect Stefano Boeri and opened in 2014, connect architectural and ecological agendas. The project combines the architectural type of the high-rise building with a vertical green screen along attached terraces.



Fig. 6. Stefano Boeri: *Bosco Verticale*. Milan. 2015.

The enclosure of a building by a vertical forest does not quite yet represent the organic intermingling of organisms, technologies and structures that some proponents of the ecological hyper-architecture discourse envision and also formally sketch. But the *Bosco Verticale* represents a transition. It marks the continuation of a tradition of creating micro-ecosystems that is typical of southern European

countries like Italy and that can also be found in the historic fabric of the city of Milan. Terraces and courtyards are designed and extensively greened in order to improve the local microclimate and thus the habitability of spaces through the cooling effect of the plants. Furthermore, the project translates these systems into a hyper-scale through a technological and structural effort, putting them to use where they have not been used before, allowing vegetation to grow along a high-rise building while changing the character of the type of architecture that is synonymous with the modern metropolis. The project brings plants and organisms into a new elevated habitat generated by architectural concept, while expanding the city's green reserves. The realization of the *Bosco Verticale* or similar projects such as *One Central Park* in Sydney may illustrate an acceleration of developments that are concerned with the incorporation of elements of nature into architecture. This does not yet imply a systematic alteration and bio-technological enhancement of the built environment, which would then constitute a framework and indicator for a change in social and cultural constellations.

## Images

Fig. 1 Ernst Haeckl, *Kunstformen der Natur* (München / New York: Prestel, 1998).

Fig. 2 Daniel Grünkranz.

Fig. 3 Daniel Grünkranz, inventory of the library of the University for Applied Arts Vienna.

Fig. 4 Francois Roche, Stéphanie Lavaux and Jean Navarro, "ImlostinParis," accessed August 28, 2015, <http://www.new-territories.com/lostinparis.htm>.

Fig. 5 Vincent Callebaut Architectures, "Asian Cairns. Sustainable megaliths for rural urbanity," accessed August 28, 2015, [https://vincent.callebaut.org/object/130104\\_asiancairns/asiancairns/projects](https://vincent.callebaut.org/object/130104_asiancairns/asiancairns/projects).

Fig. 6 Daniel Grünkranz



- 1 The magazine *Architectural Design*, for example, continuously publishes such concepts. Its issues provide an inside view of the ecological hyper-architecture discourse.
- 2 Luigi Puglisi, *Hyper Architecture. Spaces in the Electronic Age* (Basel, et.al.: Birkhäuser, 1999), 60.
- 3 Jon Goodbun, "Gregory Bateson's Ecological Aesthetics – an addendum to Urban Political Ecology," *field journal* 4, no.1 (December 2010): 37.
- 4 Amy Kulper, "Ecology without the Oikos: Banham, Dallegret and the Morphological Context of Environmental Architecture," *field journal* 4, no. 1 (December 2010): 68.
- 5 Ernst Haeckl, *Generelle Morphologie der Organismen* (Berlin: G.Reimer, 1866), 286-87, cited in : Kulper, "Ecology without the Oikos," 68.
- 6 Kulper, "Ecology without the Oikos," 68.
- 7 Goodbun, "Ecological Aesthetics," 39.
- 8 Ibid.
- 9 David Cunningham, "The Concept of metropolis: Philosophy and urban Form," *Radical Philosophy* 133 (Sep/Oct 2005): 20.
- 10 Jason Payne and Heather Roberge, "Matter and Sense," in *Softspace. From a Representation of Form to a Simulation of Space*, ed. Sean Lally and Jessica Young (London / New York: Routledge 2007), 128.
- 11 Conversation between Sanford Kwinter and Jason Payne, in: *From Control to Design: Parametric/algorithmic architecture*, ed. Tomoko Sakomoto and Albert Ferré (Barcelona: Actar, 2008).
- 12 Kwinter and Payne, 2008.
- 13 Ibid.
- 14 Ibid.
- 15 Lydia Kallipoliti, "No more schisms," *Architectural Design* 208 (Nov / Dec 2010): 16.
- 16 Kallipoliti, "No more schisms," 20.
- 17 Ibid., 15.
- 18 Ibid., 16.
- 19 Francois Roche, *Alchimis(t/r/ick)-machines*, <http://www.new-territories.com/roche%20text.htm>, 28.09.2015.
- 20 Francois Roche, "(Science) Fiction, Ecosophical Apparatus and Skizoid Machines," *Architectural Design* 208 (Nov / Dec 2010): 66.
- 21 Ibid., 68.
- 22 Bruno Latour and Couze Venn, "Morality and Technology. The End of the Means," *Theory, Culture & Society* 19, no. 5-6 (December 2002): 247.
- 23 Latour and Venn, "Morality and Technology," 254.
- 24 Ibid., 253.
- 25 Ibid., 254.