Not as “Machine” But as “Life”

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fig-1 Analog Watch

In this poster, opposition is taken to the model that can be called “**Machine**,” that was the main architectural model in the 20th century. At the same time a stance is taken that “**Life**” is suitable as the architectural model for the 21st century - as seen from various viewpoints, for example, philosophy, the relation between the part and the whole, function, geometry, the response to environment, time and so on.

“**Life**” here is not an analogy of a mere living thing, even though it includes the biological life, of course. It is an ideal and abstraction of life itself, life as a system, and it is closely related to the idea of artificial life.

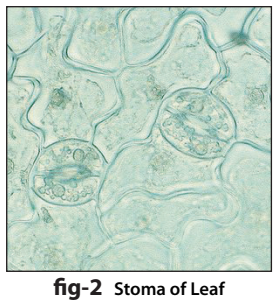

fig-2 Stoma of Leaf

1. The architectural model in the 20th century : “Machine”

In the 20th century the idea of the “**Machine**” became the predominant model for architectural as well as scientific thinking. An analog watch represents a good example for the model of the “**Machine**”. (fig-1) The features of the “**Machine**” are the following.

1. It consists of various parts with a clear outline. (**part and whole**)
2. Each part is elaborately combined. (**relation**)
3. An extremely precise working (**function**)
4. A specific kind of beauty is derived from its functionality (**aesthetics**)

Such an idea is known as **element reductionism** in science. On the other hand, it has been created in the field of architecture based on the aesthetics of “**Composition**” (**static balance**), that is, an elaborate combination of parts and the concept of “**Function**” to demonstrate that the result is the same as the expectation. And, it guaranteed a machinelike beauty.

2. The architectural model in the 21th century : “Life”

The architecture of the 20th century brought about the spread of the air-conditioning machine, and became a big factor in the growing global environmental problems. Simultaneously, the problems and the limits of **element reductionism** become clear in the field of science. As a result, the science of **complex systems** has arisen. For these reasons, it is necessary to find a new model for the architecture of the 21st century, one that is not following the idea of the “**Machine**” but another something. I propose “**Life**” as the model. (fig-2) The essence of life is "**Dynamic equilibrium**", that is, "**Flow**" that changes, keeping constancy - as described by the molecular biologist Dr. Shin’ ichi Fukuoka.

3. Aesthetics of "Machine" : Relation between part and whole Composition / Static Balance

“Machine” denotes a configuration and interrelationship of things, as well as an overall effect. The logic of its parts and whole is as that of a machine.＊1

Many architects of the 20th century assumed "**Machine**" to be a model suitable for architecture. For instance, the thesis "The house is a machine for living in" by Le Corbusier is enormously famous.＊2 It can explain the aesthetics of the "**Machine**" according to two or more parts, elements, and their combinations, that is, the concept of "**Composition**". (fig-3) In "**Composition**", it is necessary to arrange a lot of elements with a clear outline elaborately and appropriately like an analog watch. I should like to name the architects of De Stijl as a good example. In fact, Theo van Doesburg who became known as the head representative of De Stijl called the possibility of a new expression of the machine “the **mechanical aesthetics**”.

Characteristic of the architecture of De Stijl is a combination of elements painted in three primary colors. (fig-4) Moreover, a certain kind of sense of balance, that is, a **static balance** including color is requested when vertical and horizontal elements are combined. For example, in the Schröder House designed by Gerrit Thomas Rietveld, vertical and horizontal elements are splendidly composed. (fig-5)

fig-3 GeorgesVantongerloo “Construction y=-ax2+bx+18” (1930)

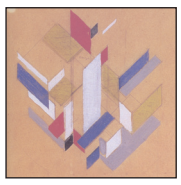

fig-4 Cornelis van Eesteren /Theo van Doesburg “Counter-construction”(1923)

fig-5 Gerrit Thomas Rietveld “Schröder House” (1924)

fig-6 Kisho Kurokawa “Yamagata Hawaii Dreamland” (1966)

4. The concept of "Function" in the model of “Machine”

The machine executes it's work in extreme precision thanks to its' various parts' being appropriately combined. This is the concept of "**Function**" within the model of the “**Machine**”. In other words, the performance of the machine is demonstrated with the relation to which the part and the part are appropriate. This is the "**Function**". If this is applied to architecture, at first, the building is broken down to various elements associated with human life. And next, a primary shape, for instance, is given to each element. This method is following the idea that architecture demonstrates a machinelike performance according to an inevitable unity of those elements, that is, appropriate relation. In addition, since this architecture was free of uselessness due to it's machinelike character, and since uniting the elements adequately was reasonable, there was an aesthetic guarantee of beauty.

This is **functionalism**. The idea of **functionalism** is frankly shown in the declaration "The house is a machine for living in" by Le Corbusier. **Functionalism** can be read as a mathematical function principle, too. In the mechanistic theory on world recognition by breaking down each element into some smaller elements, and understanding them because of their relation to each other, it was a **linear function** that the modernist architecture assumed as the relation. The part and its usage correspond to the whole one to one, and they have a permanent relation of invariability, similar to the permanent fixation of roles of parts in a machine.

5. Methodology : Element Reductionism vs. Complex Systems

The aesthetics of a **static balance** of vertical and horizontal masses (fig-03), that is, “**Composition**” greatly characterizes the modernism architecture of the 20th century. The relation between the part and the whole seen here is, so to speak, the relation of addition. It is characteristic of the machine, and also of a lot of architecture built in the 20th century except Expressionism, and Metabolism group of Japan etc.＊3 (fig-6) Similarly, the **element reductionism** in modern science might be called a dividing calculation. It follows the idea that a difficult problem can be solved by dividing the big problem (whole) into smaller partial problems. First of all, we solve easy partial problems. Next, it is thought that an originally difficult problem should be able to be solved by appropriately considering the relations between those partial problems - like combining cogwheels. However, it has become clear that there is a limit to understanding of the world by dividing it like in the **element reductionism**. Something important is lost as soon as the problem (whole) has been divided - similar to the loss of something important when a living thing is cut into pieces. That is because all elements of the world are mutually related and connected with each other, corresponding to the relationship of one to many.

In contrast to the **element reductionism**, the science of **complex systems** has emerged in recent years, which tries to handle complex problems as being complex. For this, technical progress is a big advance as it came to be able to analyze structures wholly, as for instance complex geometries. But, the importance of the science of **complex systems** lies in the point that it is shifting priority from analysis to the logic of **generation**. The methodology of **artificial life** with which vital phenomena are approached within the **synthetic theory** today, clearly shows the methodology of the science of **complex systems**.

6. Geometry：Composition vs. Seamless, Topological and Fractal

As we have seen, a machinelike, inevitable uniting of elements which are correspondent to human life was the ideal method of modernist architecture, supported by the concept of "**Function**". In addtion, it is an arrangement of big and small, of various parts along a **right-angled grid** of three dimensions and within **static balance.** This is the geometry of architecture that follows the model “**Machine**”.

For a long time, a living thing has been thought of as a machine that consists of the combination of a variety of parts that can be exchanged. Still now, such an idea is deep-rooted, as for instance the practice of organ transplantation shows. However, the idea that a living thing is quite different from a machine made by the accumulation of parts has emerged due to the remarkable development of biology in recent years. Although the components of a machine have a plain outline, and we can distinguish its parts, everything is connected with the body of the living thing, and we cannot distinguish its parts easily. Therefore, we can say that the boundary of its part is not clear but the whole is **seamless** like the form characteristic of the living thing. For instance, in the first half of the 20th century Erich Mendelsohn has already described that "the organic structure has a relation that might not be refused, a consistent increase, and an outline without a joint.”＊4 (fig-7) **Folding architecture** within which all floors, walls, and roofs are connected is **seamless,** and is obviously different from architecture that is made up by a combination of components. (fig-8)

fig-7 Erich Mendelsohn “Einsteinturm” (1921)

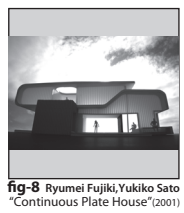

fig-8 Ryumei Fujiki,Yukiko Sato “Continuous Plate House”(2001)

Seamless corresponds to **topology** if it is caught geometrical. The geometry of an architecture of which the model is “**Life**” is not **Euclidean geometry**, but **topology**. Its form feature is **seamlessness** and it is united into one because there is no distinction between floor, wall, roof, pillars, beams etc. (fig-9) It does not follow the poetics of the right angle but it is based on a geometry comprised of **Nurbs** curved surfaces like a jellyfish. (fig-10) Benoît Mandelbrot coined the term “**Fractal**” for the geometry in nature. “**Fractal**” is **jaggy** geometry which cannot be differentiated everywhere while **topology** is **smooth** geometry. Or, it is **complex** geometry that involves the concept of **random**.＊5 (fig-11) The geometry of architecture of which the model is “**Life**” will be **topology** or “**Fractal**” because life is a part of nature.

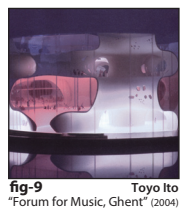

fig-9 Toyo Ito “Forum for Music, Ghent” (2004)

fig-10 Ryumei Fujiki “Aqua-scape The Orangery version”(2009)

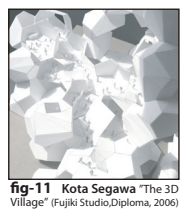

fig-11 Kota Segawa “The 3D Village” (Fujiki Studio,Diploma, 2006)

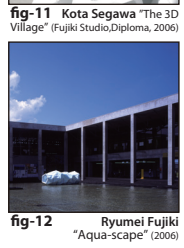

fig-12 Ryumei Fujiki “Aqua-scape” (2006)

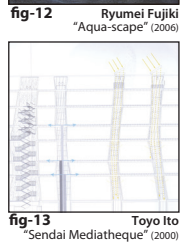

fig-13 Toyo Ito “Sendai Mediatheque” (2000)

7. System of Life : Response to Environment and Dynamic Equilibrium

The key feature of life is the communication with the external world, that is, environmental response. Although the position and the role in the whole are fixed, like for example the cogwheel in the machine, the cell in an organisms quite different from the cogwheel. The cell can decide how I behave through mutually communicating with its environment. The whole is generated only because of a dynamic relation between the parts, and each part is a living thing in itself - or the life. The flow of the molecules keeps relating mutually to the others to maintain an order as a whole even though it flows. Our body keeps constancy despite the fact that cells are being exchanged. In a word, the system of “**Life**” does not so much depend on each constituent element -that is the material infrastructure- but is an effect that the flow brings. Such an order seen in life keeps a subtle balance while flowing among without determination. Rudolph Schoenheimer calls this the “dynamic state”, and Shin’ ichi Fukuoka is calling it “**Dynamic Equilibrium**”.＊6 It is not a **static balance** in the aesthetics of machine. If we can say that the essence of “**Life**” is in the **flow** itself, as a consequence we have to look for an architectural idea that is not based on static order but on the **fluid thinking** that is applied in understanding the movements of a whirlpool as well as turbulent flow, etc. (fig-12) Similar to how the decision of a cell affects my behavior through communication, life maintains constancy while always exchanging it with the environment, that is, the external world. Communication means the exchange of molecules, the exchange of energy, the exchange of information, and those flows. (fig-13) Therefore, the boundary between an organism and the environment is vague. It is not an exaggeration to say that the organism is a part of the environment and an environment itself. Therefore, the life is sustainable.

Contrary to this, an interior space in the modern office building made in the 20th century has been designed on the basis of the concept that all places would be controlled artificially to become homogeneous constant environments by making full use of lighting and air conditioning. However, this artificial environment control needs an enormous amount of energy. Therefore, architecture in the 21st century, based on the model of “**Life**” will have to respond to the outside environment effectively without relying on artificial energy.＊7 (fig-14)

8. Factor of Time : Seed Programming

The machine is unrelated to the factor of time. It is possible to make it from any part fundamentally. Parts can be extracted and exchanged after the machine has completed. There is not one time character that it is not possible to do over again twice there.＊8

However, the **factor of time** is extremely important for life. There is always a flow of irreversible time in life including meaning of advanced time to death. (fig-15) Moreover, various molecules that determine vital phenomena are produced with specific timing in a certain specific place. For example, dynamically re-structuring throughout it’ s life span, bones represent a continuously changing and evolving living structure, and adaptive to it’ s environment.＊9 (fig-16)

By the way, there is a beautiful village on Santorini Island of Greece. (fig-17) This traditional village is quite different from an architecture and a city that would be based on the model of the “**Machine**”. Architecture and the city in the modern age until now have been made based on the blueprint drawn by the designer or the planner. And, it has been an ideal to complete everything in the shape specified by them. However, it is impossible at all to plan and to control a complex object like the city. Moreover, the **factor of time** seems to lack in such a planning method. Contrary to this, there is a considerably different planning method in the mechanisms of the natural world, especially “**Life**”. For instance, if a plant seed is sown, it is guaranteed to bloom, to bear fruit, and to bear a new seed. However, how many flowers of which size at which position will bloom changes depending on the environmental conditions, and is greatly influenced by contingency, even in case of being under the same condition. It is not important to make the flower of the decided size at the decided position beforehand. In a word, both a certain planning and the flexibility that can correspond to changes in the environment are contained in one seed at the same time. I am calling such an advanced planning theory like sowing seed “**Seed Programming**”.＊10 (fig-18)

The village on Santorini island repeated collapses and updates due to earthquakes that happen one after another. But, It has never lost the characteristics of the village on Santorini island. Here, everything is integrated, and a part cannot be taken out - unlike in the zoning of modern city planning, in which the outline and the function of each part are plainly divided machinelike. According to the only rule, that of orienting the windows of each room towards the view of the sea, a new space will be arranged, based on its the relation to the surroundings.＊11 This is entirely the same process as that of how the cell decides how I behave by exchanging information with its surroundings. Therefore, it can be said that the village on Santorini island is a good example of architecture or the city where “**Life**” is assumed to be the model.

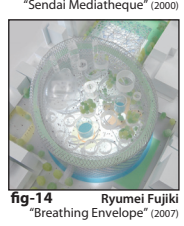

fig-14 Ryumei Fujiki “Breathing Envelope” (2007)

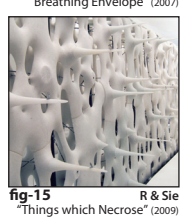

fig-15 R & Sie “Things which Necrose” (2009)

fig-16 Ross Lovegrove “CELLULAR AUTOMATION”

fig-17 Santorini Island, Greece

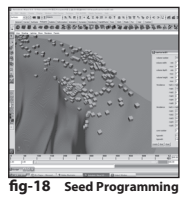

fig-18 Seed Programming

＊1 : Hiroshi Hara, **“Machine” and “Wind”**, included in “GA ARCHITECT 17 Toyo Ito 1970-2001”, A.D.A. EDITA Tokyo 2001
＊2 : Le Corbusier, **“Vers Une Architecture”**, Les Éditions G. Crés et Cie, 1924
＊3 : Kisho Kurokawa, **“From the Age of the Machine to the Age of Life”**, included in “RETROSPECTIVE KUROKAWA KISHO Exhibition Catalog”, Book Art, London 2001
＊4 : Reyner Banham, **“Theory and Design in the First Machine Age”**, Architectural Press, 1970
＊5 : Takaaki (Ryumei) Fujiki, **“A Description and Generation of *Random Patterns*”**, Doctor Thesis of University of Tokyo, 1993
＊6 : Shin’ ichi Fukuoka, **“Dynamic Equilibrium”**, Kirakusha, Tokyo 2009
＊7 : Ryumei Fujiki, **“Breathing Envelope”**, The Symposium of Climatic Cube, Annual Meeting of Architectural Institute of Japan 2008
＊8 : Shin’ ichi Fukuoka, **“Seibutsu to Mu-seibutsu no Aida”**, Kodansha, Tokyo 2007
＊9 : Ross Lovegrove, **“CELLULAR AUTOMATION Origin of Species 2”**, 21_21 DESIGN SIGHT EXHIBITION 4 “Second Nature” DIRECTED BY TOKUJIN YOSHIOKA, Exhibition Catalogue, Tokyo 2008
＊10 : Ryumei Fujiki, Kota Segawa, **“A Study on Advanced Planning Theory and Method like Sowing Seed by 3d-modeling and Generating a Traditional Village Form (1),(2)”**, Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan 2008
＊11 : Arata Isozaki, **“Non-transparent Space”**, included in “Villages and Towns in the World #1 Aegean Sea”, A.D.A. EDITA Tokyo, 1973

Fig-3,4,5 : Sezon Museum of Art, “De Stijl 1917-1932 : Art and Environment of Neoplasticism”, Exhibition Catalogue, Tokyo 1997
Fig-6 : Kisho Kurokawa, “Contemporary Japanese Architects 21”, San-Ichi Syobo, Tokyo 1971
Fig-9 : Marie-Ange Brayer, Frederic Migayrou and Fumio Nanjo, “archilab’ s urban experiments: Radical Architecture, Art and the City”, Mori Art Museum 2004, English-language edition Thames & Hudson, London
Fig-10 : took by Porl Medlock, photographer
Fig-11 : took by Kota Segawa
Fig-12 : took by Hiroshi Ueda, photographer
Fig-13 : Toyo Ito Design Office, “Architecture : Non-linear Events”, Shokokusha, Tokyo 2002
Fig-14 : took by Tomoyuki Suzuki, photographer
Fig-16 : Ross Lovegrove, “CELLULAR AUTOMATION Origin of Species 2”, 21_21 DESIGN SIGHT EXHIBITION 4 “Second Nature” DIRECTED BY TOKUJIN YOSHIOKA, Exhibition Catalogue, Tokyo 2008
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