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How cybernetic is parametrization?

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“And what takes the place of philosophy now?
HEIDEGGER: Cybernetics.”
Interview for the magazine Der Spiegel, Germany, 1966.

Parametrization is being introduced for years in education and in architectural designs around the world. To be used in its full potential, it demands a revision from the actual focus in design of the form giving, still a central part of architectural design practice and education. According to Hugh Dubberly, the shift should be to concentrate on the process’ planning as a whole, establishing relations between object and environment, and actor who occupies both (Dubberly, 2008, p.9).

Parametrization isn’t new. Originally, it was born with the Sketchpad development, in 1963 by Ivan Sutherland, which was "a mechanism based on propagation and, at the same time, a simultaneous solver." (Woodbury, 2010). Parametric Design derives from the Graph Theory and, within that, from the propagation-based system, which assumes that the user organizes the graph, so that it can be directly solved. According to Robert Woodbury, this is the simplest type of parametric system, organizing objects so that the known information is based on unknown information. Knowing the theories behind the parametric design, the principles, advantages and fields of knowledge needed to master how to do it, which means, design with code, focusing on information management and its visibility in areas such as Building

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Information Modeling [BIM] and File to Factory, becomes a professional survival strategy in a competitive and international market based on expertise (Woodbury, 2010).

Going beyond the conventional way of adding and deleting design decisions, parametrization adds the ability to relate and modify parts of the project within the coordinated set, assuming that fundamental changes bring changes in the systems and in execution form. The comparison of parametrization with music allows us to glimpse the difference in the production, since the "musician is dedicated to rehearsing for performance", this being an essential feature also of parametrization (Woodbury, 2010, p.24). As a conceptual example, it is very interesting as it highlights the difference of the focus on the role of performance within the design process as a guideline for decision making. The conceptual references of modern architectural production were often sought in fine arts, observing the composition order that allowed the understanding of the form, in a static way. Music as a concept for parametrization is, in turn, the actor's relation to its object and the environment, and the performance is the aspect of temporality of interaction in between its parts. As music production, parametric production works with the idea of meetings and paths, called nodes and vectors, establishing relations, allowing an interactive behavior of building components and systems (Woodbury, 2010, p.24).

Being performance the center of parametrization, focusing on the behavior of what is intended to be projected, it includes necessary revisions of references and method, which the cybernetic Heinz von Foester had already predicted in the 1960s, proposing an organic system, instead of focusing on a mechanical object design. Hugh Dubberly and Paul Pangaro highlight the relation between design and cybernetic methods, proposed by Horst Rittel and Heinz von Foerster, both in the 1960s. Foerster describes "the shift of focus in cybernetics from mechanism to language and from systems observed (from the outside) to systems-that observe (observing-systems)." (Dubberly, 2008, p.8).

Horst Rittel differentiated two orders in the design process: the First Order sees the design process as optimization, troubleshooting, linearly. Decisions are based on facts. The Second Order defines the design process with argument, structured in goals, receiving multiple returns, the decisions are instrumental. The temporal performance of the First Order is in the present; while the second, which is more speculative, is in the future (Dubberly, 2008, p.8). When comparing the two cybernetic orders, it is seen that the First Order understands the design process as a single circle of action, controls throughout the process and regulation in the environment. It is a system observed externally, decisions try to be objective. However, the Second Order is the process with a double circle of learning opportunities and the possibility of participating through conversation. The system observes itself, being the actors parts of the system, enabling the joint creation of goals. Decisions allow subjectivity (Dubberly, 2008, p.8).

Establishing a parallel between both the review's goals, the First Order to the Second Order, we see a clear link between the parametric goals and the Second Order aspects of both the design method and cybernetics, which understanding should allow to go beyond the form search, reinforcing the criticism towards the reductionist idea of a mechanical object design, giving way to planning an organic system that will respond better to the yearnings of an architect who thinks in the future.

In order to contribute to a greater understanding of the cybernetic role on the implementation of parametrization as design strategy, you're invited to observe three cybernetic key concepts. To understand the foundation pillars of what stimulates the parametrization development and the necessity of its full inclusion in education and professional practice, primarily the cybernetics formulated by Ross Ashby will be introduced, the formal science of an ideal machine. To include the object's systemic aspect, the viable system theory proposed by Stafford Beer is of fundamental importance, which complements the understanding between object and environment. Cybernetics, which has at its center the Steerman as a metaphor for

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the individual, should also contribute to reflections on its role in the process and the interaction among parts, developed by Gilbert Simondon.

FORMAL SCIENCE OF AN IDEAL MACHINE

One of the founding pillars of parametrization, that establish a start on the development of preceding concepts, are the theories of Ross Ashby expressed in his book "Design for a brain," published in 1952. For the first time, Ross Ashby described an organism as a machine. Considering the "[...] technique of applying this assumption to the complexities of biological systems [...]" (Ashby, 1960, p.30), he referred to the assumption that the living organism, in its own nature and process, is no different from no other subjects. Ashby identified that an organism behavior is specified by its variable, thus "all bodily movements can be specified by coordinates" (Ashby, 1960, p.30).

Ashby studied the connections involving the organism and the environment, such as the relation between them. His definition of the homeostasis is essential for the mechanism, and clearly shows the reason why it can provide an ideal base divided in three items:

"(1) Each mechanism is 'adapted ' to its end. (2) Its end is the maintenance of the values of some essential variables within physiological limits. (3) Almost all the behavior of an animal's vegetative system is due to such mechanisms." (Ashby, 1960, p.58).

For Ashby, the characteristic that defines the "adaptation" is the relation of dynamic balance with the world. The dynamic balance is the fundamental characteristic of life. After this hypothesis, it was found that many organisms possess this mechanism in order to interact with the environment, formulating his theory of the ideal machine based on this principles.The exemple of the Homeostat, an ideal machine element, is an electro mechanic device, with four identical homeostates, all of them interconnected. Each homeostat unit is a device that converts electrical inputs in electrical outputs. Ashby understood these currents as the essential varieties of the homeostat. With this machine, he tried to conserve the system in a limit in which he could clearly understand the varieties. The definition of homeostatic is the relation between the inputs and the outputs, in which the units can operate on these two forms according to the configuration (Pickering, 2010, p.101). Therefore, Ashby managed to assemble an ideal machine, which can comprehend the operating system of the human brain. This ideal machine was the result of twenty years of work and research by Ashby, which transformed Cybernetics to be a formal Science (Pickering, 2010, p.105).

According to the biologist James Lovelock the homeostasis gathers the body's wisdom in which it maintains the constant state, even with external or internal environmental changes occurring. According to him, in the living organisms, the homeostasis isn't the permanent constancy, but the dynamic constancy stage. A living organism can avoid the collapse and move to a new constancy stage and begin a new limit without fail (Lovelock, 2006, p.140).

Lovelock appropriates of one of the first definitions of cybernetic when he exemplifies the homeostasis, citing the steerman of the ship in a storm situation with rocks in its course adjusting the ship for a new stable path. Even with the change in the First Order Cybernetics to the Second Order, the interest continues to be the understanding of the adaptive process.

An example of architecture that has as its goal Ashby's ideal machine is the capsule that was developed to go the moon. Its design was an effort of a group of experts, imagining a program and functionalities without any design reference. When looking for innovation in the field of architecture, you don't start from form nor from predefined programs, but from the attempt of understanding behavior and performance between object and environment and its user. We can affirm that the ideal machine concept, allowing self-regulation, adaptability and review through variables that come up, is an intact part of the parametric process, including in simulation and verification programs, coupled to the programs.

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VIABLE SYSTEM MODEL

Aiming to supplement the relation between the object and the environment, with a more systemic and organic character, there is a second cybernetic aspect, the Viable System Model (VSM, shown in 1972, in the book "Brain of the Firm") by the cybernetic and manager Stafford Beer. He starts with a reference to a nervous system to explain the viable system's goals, once it is the most complex system in the universe and the most wonderful in control engineering's point of view. Nature brought the beginning of the project's design on organization, replicating the biological organisms as the viable system structure (Pickering, 2010, p.244). For Beer, all the viable systems contain and are contained in a viable system. For the system to be viable, it needs to be dynamic and complex, and that means the system changes constantly. Beer matures his ideas and his explanation about the Viable System Model, making it an applicable method for business companies. His system was structured through five subsystems, which can be applicable in all other systems (Figure 1).

The First System is the operation; it means that it is the process element. The system has, directly, links to its environment users. Besides that, the First System has its own management, which is responsible for internal resources distribution (Leonard and Beer, 1994, p.47); System Two has the function to harmonize the activities in the First System operations, or in cybernetic terms, it reduces the oscillation of different operations' links (Leonard and Beer, 1994, p.48); System Three is responsible for the First System's management, as to coordinate the units so they don't fall over each other and to bring more effectiveness to the system. System Three has a special audit function which can be an internal or external procedure, such as an external consultant (Leonard and Beer, 1994, p.48); System Four is directly connected to the environment, as well as the First System, looking at the hypothetic future of "near, mid and long term" (Leonard and Beer, 1994, p.49); System Five is the identity of the entire system, and a unit of all the dreams of the members that compose the system (Leonard and Beer, 1994, p.50).

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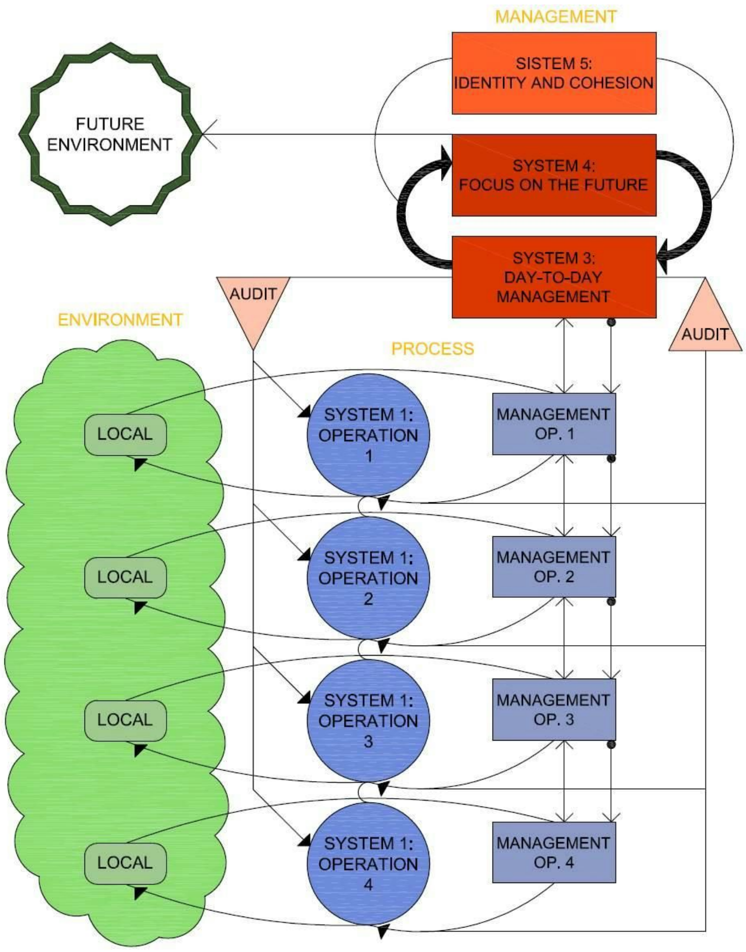

Figure 1. Viable System Model with the subsystems 1-5 from Beer, 1994. Author of the image: Mariah Guimarães Di Stasi.

Beer defines cybernetics as the science of effective organization. Five organizing principles guide the viable system, including maximum individual autonomy tempered by solidarity and subsidiarity, cooperation and coordination, including non-oscillation and damping, execution and organization for synergy, transparent and reliable; collective intelligence and strategic planning; planning based on identification with the purpose, looking for common values, principles and vision.

In relation to parametrization, this time seen as a model of information organization, a single model, fed in real time by various contributors to the proposal, the VSM offers us principles for observing, that evaluate and correct during the intervention's lifecycle, either in the case of a building architecture or in urban planning starting from variables and unexpected outcomes, called as noises that can arise. Adaptation and Innovation

The English architect Cedric Price had the interesting habit of presetting the expiration date of his projects, not only by the durability of the material to be used, the economic issues, but by the functionality of the proposal within the environment system. He said he could not guarantee the proper functioning of the building after its due date and it should be demolished. To prevent permanent demolition of buildings and habitat systems that become obsolete, the strategy is to define the architectural object, not as a static container doomed to remain beyond its useful time. Enters the concept of the open machine that allows changes, in order to adapt to the environment in permanent change. According to the philosopher Gilbert Simondon:

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> "The machine that is equipped with a high tenacity is an open machine, the set of open machines presupposes the man as the permanent organizer, as a living interpreter of a machinery in respect of others. [...] It is also through this margin of uncertainty and not by automations that the machines can be grouped into coherent sets, exchange information with each other via the coordinator that is the human interpreter" (Simondon, 1989, p.11, our translation).

Including the challenge of designing an ideal machine (Ashby, 1960) in order to be part of the geography (Simondon, 1989), within a viable system (Beer, 1994), enhances, in our opinion, the parametrization that permeates the entire life cycle.

A better understanding of the parametrization impact so as to build the habitat is still lacking. In 2009, the cyberneticist and architect Ranulph Glanville, disagreed with me in a conversation about the relation of cybernetics with parametrization. He was right not to recognize this relation at this time in which numerous examples of initial parametrization were aesthetic objects by using computational tools without, therefore, understanding the structural and conceptual changes needed to develop another way of organizing the habitat.

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