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GAME OF LIFE

On Architecture, Complexity and the Concept of Nature as a Game

A few years before Watson and Crick discovered the structure of DNA (Watson & Crick 1953) and shortly after the publication of Schrödinger's *What is Life?* (Schrödinger 1944), John von Neumann's famous 1948 lecture at the Hixon Symposium helped contribute to the convergence between computer and natural sciences. Based on aspects of information theory, von Neumann's ultimate goal was to create a cellular automaton as a biological machine. The difference between von Neumann's approach and earlier automata concepts was the idea of "information." He wanted to implement not only a determined plan of behavior, but also the capability to reproduce itself. Thus the goal of von Neumann's investigation was to develop mathematical rules that simulated the evolutionary principles of nature.

A simpler example of how basic rules can steer a complex entity is the mathematical game developed by John Conway in 1968, called the *Game of Life*. The game became widely known when it was mentioned in Martin Gardner's article, "The Fantastic Combinations of John Conway's New Solitaire Play of Life," published in *Scientific American* in 1970 (Gardner 1970). "*Game of Life* wasn't actually a game that you played," writes scientist Mitchell M. Waldrop. "[...] It was more like a miniature universe that evolves as you watched" (Waldrop 1992, p. 203). It represents a simplified version of cellular automata and is strongly inspired by the preliminary work of von Neumann. The latter was interested in the underlying rules of evolution and self-reproduction; Conway's goal of designing a set of simple mathematical rules able to generate complex patterns of life-like behavior is similar in spirit.

For a few years now, architects have been increasingly exploring self-organizational and evolutionary processes of complex structures in nature. "Is the new Nonlinear Architecture somehow superior, closer to nature and our understanding of the cosmos, than Old Modernism?" asks architect Charles Jencks in reference to the growing significance of irregular geometries in contemporary architecture (Jencks 1997, p. 7). Increasingly, modern architecture relates to the field of complexity science, which Stephen Wolfram recently titled, "A New Kind of Science" (Wolfram 2002). Nowadays, complexity in architecture is instead understood as the built emergence into nature. Both this new understanding of architectural complexity and the trend of Nonlinear Architecture require a specific conceptualization and view of nature. But a question inevitably arises from Jencks' characterization of Nonlinear Architecture as potentially "closer to nature" than Old Modernism – namely, what does "nature" mean to contemporary architects? In other words: what model of nature does the part of the scientific world that investigates self-organizing and nonlinear processes communicate to architecture?

Since the first half of the 20th century, models of nature in architecture have been mainly shaped by technical and conceptual progress in the natural sciences. Gyorgy Kepes' *The New Landscape in Art and Science* (1961) impressively illustrated how the visual language of modern art and architecture is linked to scientific images of microstructures scaled up with electron microscopes. On many levels, the technology of computation has changed the way we construct our world. The mathematical subject "nonlinearity" was introduced by Henri Poincaré in 1890, but has been further developed in recent years because new tools and computers allow researchers to simulate and visualize self-organizing and evolutionary processes in ways that were previously impossible. Such processes produce not only an architectural language of irregular geometries, but have been applied as a new type of "techne," primarily addressing problems of structural optimization in architecture.

Today, we live in a society frequently characterized as information-based; that is, one in which information serves as the basis for the ongoing course of cultural and technological globalization we are experiencing. Mathematician Benoît Mandelbrot argues that the idea of information will play a key role in understanding nature. And architect Antoine Picon argues further that "contrary to the traditional notion of structure, information ignores the distinction between the large, the medium, and the small, between the macro and the micro" (Picon & Ponte 2003, p. 300). Numerous processes in nature, such as growth and adaptation, are considered information-based processes described as a set of rules. Rules are also typical features of games, and laws of nature can be regarded as rules – rules of the game of nature. This means that rules of games can simulate laws of nature.

Playful Notions in Architecture

In the consideration of the fast-growing application areas of new computational technologies, there is an increasing interest in the question of how and by what means the interrelations between game, design and technology have affected spatiotemporal ideas in architectural planning.

The role of games in architecture and architectural discourse is based primarily on sociological concepts. Reconsidered today, the artistic manifestos of Jacques Fillon, Constant, Yona Friedman, Guy Debord and other Situationists can be seen as prominent examples of how the idea of "playful interaction" was employed by those seeking to reformulate social structures.

The notion of "game" is discussed frequently in the context of participating urban design, in which the design philosophy implicitly includes aspects of interaction, communication and cooperation. Such discussion derives from the similarity and comparability of certain features present in both processes: playing and planning. Architecture understood in this context is regarded as a collective game based on a set of constraints. It is important to note that in every such sociological model of gaming, there is an all-important subject who participates in the game, takes action, often collaborates and tries to reach a certain goal.

Separating the Subject from the Game

Philosopher Hans-Georg Gadamer has extensively discussed the subject's role and meaning for games from an epistemological point of view. In *Truth and Method*, he distanced himself from the subject-oriented approach argued by Kant (Gadamer 1960). Instead, he pleaded for a separation of the subject from the game itself and disagreed with what he called the "subjectification of play." Gadamer sought to change the object of investigation from the subject to the game itself: "Because the game has its own character, independent of the awareness of those playing it. And the game also intrinsically exists there where no independent being of subjectivity limits its thematic horizon, and where there are no subjects who comport themselves playfully" (Gadamer 1960, p.109).[1] Gadamer described the idea of play by means of motion, which implicitly exists within the play, and he assigned special significance to the process of back and forth, in and out: "The movement that is the game does not end with the achievement of some goal, but rather renews itself in constant reiteration. The seesaw movement is apparently so integral to the character determination of the game that it is irrelevant who or what carries out this determination. The game movement is such that it essentially exists without a substrate. It is the game that is played or happens – not a cleaved subject that plays it" (ibid., p.108).

1 > All quotations from Gadamer were translated from the German by the editors of Space Time Play.

Nature as a Game

In the natural sciences, Manfred Eigen and Ruthild Winkler presented a similar concept meant to objectify the idea of game. As did Gadamer's, their approach went beyond the narrow definitions of game such as those, for example, used by historian Johan Huizinga. The crucial point in Eigen's and Winkler's approach is that game is considered as a natural phenomenon described as dynamical processes governed by the dialectical dichotomy between necessity (*Notwendigkeit*) and chance (*Zufall*). Gadamer's philosophical intention to objectify the idea of game anticipates in some way Eigen's and Winkler's concept of nature as a self-organizing system: "There is clearly an order to the game, by which the back and forth seesawing of its movement seems to arise of its own accord" (ibid., p.109).

To propose an answer to Jencks' opening question of whether contemporary architecture might be "closer to nature than Old Modernism," one would definitely need additional insights, particularly from history and the philosophy of science. Eigen's and Winkler's suggestion of regarding nature as nothing more then the interplay of chance and necessity as well as Conway's *Game of Life* are both based on rule-based concepts of play in which no subject is involved and needed. Eigen and Winkler reject the idea of nature as mechanistic and deterministic and provide instead a mathematical model of nature described in terms of complexity and dynamic, nonlinear, self-organizing features. A majority of scientists might not agree that this nonlinear paradigm provides new scientific insights into nature. But in architectural culture, the "New Kind of Science" still has influence. Jencks is correct when he demands that architects always explore new languages – but not only in terms of form. Architects, I would argue, must also explore new processes, processes that occur without the subject's control. The utilization of such processes is presently going to breed a new architectural methodology based on the technological conceptualization of evolutionary and self-organizing dynamics. In consequence, the conception of nature as a model of objectified game could mean that architecture, regarded as a kind of second nature, will be technologically designed and optimized to a certain degree autonomously. For the architectural discourse, this could be a productive point of departure in the future.

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