Architectural Approach and the Intro-Opening-Based Structural-Phenomenology

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Abstract

We comment in this text on the implications that Mihai Drăgănescu's extended architectural vision of intro-open systems can provide an effective conceptual framework for the structural-phenomenological approach imposed by limits increasingly touched by the process of contemporary knowledge.

Introduction

In the fall of 1978, after a meeting we had with Professor Mihai Drăgănescu to introduce him to the architecture of the system we were designing in our research group, then when I drove him to the car that was waiting for him, he gave me a small booklet with a title that contained an unusual word: *intro-opening*. Reading it, I understood the much wider scope of the Professor's intellectual preoccupations, facilitated by the special position that the field of electronics and computer science had and still has.

The text I am referring to – *Architecture and Structure in Open and Intro-Open Systems* – first published in this issue of the journal *Noema*, retains its importance 45 years from the time of its writing by the way it deals with a

concept still insufficiently clearly fixed in the field of computer science and sciences on which computer technology has fundamentally redirected them. It is about the concept of *architecture* that electronics and computer scientists have extended far beyond the original field, that of builders.

In the text I discuss below, the concept of *architecture* is extended beyond the realm of scientific forms of knowledge, into the realm of philosophical speculation. No less important are the comments on the limits of the architectural approach.

After almost half a century, the reconsideration of this text may prove important in order to evaluate recent history, but also to glimpse or project the evolutions that await us.

Into-openness

I had to wait a little over a year for the publication of the volume *The Depth of Existence* (see [Drăgănescu '97] which is the English version of the original Romanian version [Drăgănescu '79]) to clarify the meaning of the *intro-opening*. I realized first of all that the Professor's thinking was not anchored in the ideology imposed by the totalitarian regime. The ***from-in-into*** triad, which took from the non-Marxist philosopher Constantin Noica the particle *into* (*întru* in Romanian), provided a philosophical image of existence that lay above the dogmatic distinction between materialism and idealism.

The mentioned triad closes a loop through the depths of existence and proposes two types of systems: open and intro-open. The intro-opening is an opening to the depths of existence and through it has a speculative character, but which was imposed, in the late 1970s, by evidence from research at the limit of knowledge.

The paper in question will focus in the following four sections on the approach of systems, open or intro-open, from a double perspective: the conventional structural and the emerging architectural.

The concept of intro-open system is commented on in the context of continental philosophy by ignoring dialectical materialism. In 1978, such an attitude could not fail to attract my attention. Moreover, it marked a turning point in the way we approached the most subtle aspects of the electronics profession. This

event coincided with the initiation of the Functional Electronics course in the Faculty of Electronics, a course in which the concept of structure acquires a significant companion by introducing the architectural approach.

Unfortunately, even today the concept of functional electronics or the architectural approach are not clearly enough perceived in the academic environment, let alone the industrial one. For this reason, the publication of this text written in 1978 is timely and we hope it will have the impact it deserves.

Architecture

Frederick P. Brooks, Jr. opens the "Architectural Philosophy" chapter written in the volume *Planing a Computing System. Project Stretch* [Buchholz '62] with the following definition:

> *Computer architecture, like other architecture, is the art of determining the needs of the user of a structure and then designing to meet those needs as effectively as possible within economic and technological constraints. Architecture must include engineering considerations, so that the design will be economica1 and feasible; but the emphasis in architecture is upon the needs of the user, whereas in engineering the emphasis is upon the needs of the fabricator.* (p. 5)

By "engineering", Brooks refers to the organization of the computer thus making the meaningful distinction between architecture and structure, i.s., between the user's view and the designer's view.

When the complexity of a technical object exceeds a certain level, the distinction between what it has to do and how it is constructed to do what it has to do becomes necessary. Historically, this level of complexity has been reached first in the field of public construction. And so the architects and builders of buildings appeared. The definition of functionality fell to the architect, while the implementation of the construction fell to the construction engineer. (One cannot speak of the architecture of a hut, but in order to build a cathedral, the architect's conception precedes the work of the builder.)

The computer, through the two components that define it, the hardware and the software, became, in the early 1960s, a sufficiently ***complex*** entity to impose the architecture-structure distinction.

At the end of the 1970s, Professor Mihai Drăgănescu concludes that the appearance of the microprocessor in the field of electronics achieves the complexity from which it can only evolve upwards through a complementary structural-architectural approach. Electronics products are starting to become more and more the result of circuits tightly interleaved with information. Today, we call this combination embedded computing. He called this approach ***functional electronics***[1].

After Brooks' proposal, computer users came to use the term of architecture in many less explicit or distorted ways. On notorious example is the well-known example of von Neumann/Harvard architecture. In this case it cannot be an architecture because we are dealing with an *abstract model* that mediates between a mathematical model (the Turing machine that assumes "infinity" in its definition) and an achievable physical model. The complexity of the model (few interconnected blocks) does not reach the level at which the structure-architecture distinction is required. Consequently, we have to talk about the von Neumann/Harvard ***abstract model*** instead of the von Neumann/Harvard architecture.

Mihai Drăgănescu brings the following important clarifications regarding the concept of architecture:

- the distinction structure-architecture is imposed mainly in the systems in which an informational structure is developed (usually in the form of programs)
- in hierarchically sufficiently complex structured systems, architectural hierarchies can be defined that allow coherent interfacing between hierarchical levels.

The interface character of the architecture is imposed both by the binomial physical structure - informational structure, and by the hierarchical organi-

[1] In a discussion I had in the late 1980s, Professor suggested, without insisting, renaming *Architectural Electronics* the discipline of *Functional Electronics*. We decided together to keep the name of *Functional Electronics* in order not to reopen discussions on the discipline that was anyway considered somewhat exotic in our faculty.

zation of the complex systems that we add to our world (such as computer networks).

The main effect of the architectural approach is to maintain the complexity of the systems at controllable levels. The distinction between "what" and "how", which we make through architectural interfaces, simplifies the path to the implementation of complex systems. From this perspective, distinguishing between the structure of a system and its architecture is, in the first instance, a way to accelerate technological progress. But beware, beyond a certain limit of application, architectural thinking can also be an obstacle to technological progress (see the blockage that represents the x86 architecture for the evolution of the series of microprocessors that it describes).

National Information System

The third section of the analyzed paper applies the concept of architecture to National Information System (NIS) and in this way to the level of the whole society. In defining the NIS architecture, the author gives priority to state institutions, but also considers the useful functions for individuals to be taken into account. It is a visionary attitude that was expressed in 1978 and in a totalitarian state. Indeed, the IBM PC has been appearing and imposing itself on individual users since 1981, and the iPhone became a universal personal device in 2007. Prior to the 1989 events in Eastern Europe, there was no question of (cross-border) Internet communication between individuals in a totalitarian state.

The structure of a national network once established can support several architectural definitions. An architectural instantiation, once the structure of the network is functional, can also be produced through a process of self-organization, but then we cannot be sure that it will serve society and individuals. Mihai Drăgănescu considers the problem of establishing an NIS architecture to be difficult and without a solution in a predictable interval. In this sense we quote:

> *The NIS architecture is the one that stands in front of the society as a system, the architecture must correspond to the type of society we choose, even within the socialist system. That is why the problem*

> *of architecture is so difficult. We have possible structures but the architecture is not defined.*

The historical evolution of the last decades shows us that the architecture associated with the structure of communication networks has evolved chaotically under the rule of corporate criteria, neither those of the state nor those of the individual.

For Mihai Drăgănescu, the problem of the architecture of communication networks was unresolved and, unfortunately, it is the same today. Maybe that's how it should stay !?

Things get complicated when Mihai Drăgănescu wonders if society as a whole can have an architecture. Once the information-controlled processes gain an important weight, the society will also have to appropriate an architecture. This was not the case in 1978, but the author concludes:

> *"The society being, in a certain sense a system, comprising information, it also has an architecture. ... The political implications are obvious, nothing is more political in computer science than the NIS architecture."*

Architecture of the human brain

The relationship between the concept of architecture and the functioning of the human brain is made by Mihai Drăgănescu in correlation with the concepts of artificial intelligence and intro-opening.

Starting from the architecture of computing systems, the field of artificial intelligence is the one that brings us closer to the field of brain functioning. On the other hand, the intro-opening of the brain to the depths of existence will lead us to what might be called the architecture of the depths. In other words, the chain of computer, AI, natural intelligence, connection through intro-opening to the depths leads us to pose the problem of the architecture of deep reality. The previous chain forces us to gradually move from formal representations to non-formal representations consistent with an unrestricted approach to formal structuralism.

A system that is open and intro-open in the same time can be architecturally creative in the vision of Mihai Drăgănescu. In the volume that will appear after this communication was held at the Academy of RSR, at the end of 1979 [Drăgănescu '79], this particularly surprising speculation will be further developed and argued.

Thus, according to Mihai Drăgănescu, the human brain is equipped with an architecture which allows an intimate connection through intro-opening with deep reality with consequences that exceed the most spectacular aspirations of the pre-Baroque alchemists. This role given to the architecture of intro-open systems comes from an original philosophical approach that will be developed by the author in the coming decades. Man, society and the universe will be approached by Mihai Drăgănescu from the perspective of a structural-phenomenological philosophy, which is why he concludes:

> *"For man, society and the universe, therefore, the problem of architecture arises differently because these are intro-open systems."*

How different? So different that the mechanisms of knowledge will have to approach processes that go beyond formal-structuralism. The functions by which an intro-open system architecture is established will have to admit, in addition to formal definitions, non-formal definitions that describe the behaviors of some trans-systemic entities.

Architectural approach of psychological and psychological informational processes

At the end of the paper MD considers:

> *"I think that the whole argument in this introductory paper on the architecture of intro-open systems and devices reaches a climax with the consideration of* psychological architecture*, obviously of the man of the greatest interest."*

hoping that:

> *"In this way we will better understand the interaction between society and man, maybe we will understand the philosophical foundations of civilization."*

We cannot fail to notice that the proposed architectural approach represents for Mihai Drăgănescu in 1978, in a totalitarian social system based on an indisputable Marxist ideology, the way in which we have the chance to lay the foundations of a philosophy of civilization. What civilization? The question gets only an implicit answer based on an understanding of what the architectural approach entails. Without explicitly saying so, the author urges us to look for the foundations of knowledge and creation far beyond what totalitarian dogmatism offered.

Concluding remarks

The extension of architectural approaches beyond computer science allowed Mihai Drăgănescu in the following decades to initiate, inspired by [Kato '99], the use of category theory as a mathematical tool to support the structural-phenomenological approach [Drăgănescu '00]. The fact that an architectural description is focused on functional aspects, on the one hand, and the possibility that a category may contain non-formal elements, on the other hand, facilitates the connection of the architectural approach with category theory for structural-phenomenological applications.

The relevance of the text that we bring to the attention of the scientific community is to be manifested because the complexity of the investigated realities reaches limits from which, starting from the strictly structural-formal approach, it is no longer possible. The concept of architecture, based on functional descriptions, allows the control of complexities that structural descriptions cannot control.

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