Parasitic Architectural Forms (PAF) S01.E01 “Prologue”

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Abstract. The aim of this paper is to outline the main functionality of Parasitic Architectural Forms (PAF), extend on potential utilization of it in the digital era, discuss the possibility of architecture being self-designed. I raised a question if architecture could be self-growing, self-developed and self-healing. This issue is being solved by this concept of PAF. Absence of artificial intelligence in the process of design in the architecture field offers a space for new research. Also, it generates options for yet uncharted views for experimental creation and urges us to ask of what are we, people, and computers currently capable.

1. Introduction
By the end of the 20th century, the use of digital tools and techniques in architecture came to the forefront. Initially developed in the aeronautical, manufacturing, automotive, shipbuilding, aerospace and animation industries, these tools and techniques have spread rapidly throughout architectural design since the late 1980s, transforming the way architects design and implement projects forever [1]. Is it possible to move the possibilities even further? We are in the era of Digital and Post-Digital Architecture, why Artificial Intelligence in Architecture? Self-Designing Architecture?

2. Idea
At the very beginning, there was a question that would like to focus scientifically on and bring the answer. What if architecture could design, grow, develop, repair itself? It would instead start by analysing this question than answering it. There has not invented this question. It has been here since time immemorial. I am just trying to bring it to the field of research. Just traditional lamenting during construction accompanied by the lamented, “I wish it were built by itself”. Or did it become the germ of futuristic ideas? Furthermore, perhaps we owe it only to the human laziness of ingenuity, comfort, the effort to simplify life and work. For clearly define what should be the subject of research on this theme, it was necessary to define keywords on this issue. Architecture in this question means, for the dissertation of mine, an architectural construction or material. Artificial intelligence should ensure that such an architectural construction, such a material, is capable of being designed autonomously. Software capable of learning and creating. The fact that the structure should grow independently and develop, and heal, understandably repair, should be ensured by a material based on bioplastics or a composite consisting of conventional material and a biological part. Among other things, it should be genetic information material in the form of generic parameters necessary for the growth as mentioned above and development. As usual, the question creates a chain of more and more new questions. These ideas have been translated into the title of the dissertation topic: Physical Rationale for Creating Elements of Parasitic Architecture. It is the creation of the design of architectural constructions by the physics of the environment, and it will be defining and describing why such a form of designing architectural constructions should arise. The notion of parasitic architecture does not exist in principle, I introduce it with the idea of creating a manifesto in architectural design, as a precedent, a new view of creation. It means, in simplicity, additional, secondary architectural elements, it would be better starting with the
creation of smaller-scale elements, rather than just the building itself. Naturally, we will eventually reach these scales and complex self-designed objects.

3. Parasitic architecture

What is parasitic architecture? Based on the observed model from nature, the host-parasite, we can apply a mutual relationship beneficial for both sides, to the relationship existing building-additional architectural construction. The different views on this idea, whether in terms of content or form, create a broad scope for defining this model and what we can regard as parasitic architecture. Formally, for example, superstructures, extensions and installations. In terms of content, interventions in the urban structure, Urban acupuncture, where the whole improves through small interventions. If we move to a smaller scale, we can also consider vegetation facades as a parasite where, through the substrate created on the host, the conditions for the growth of greenery that can be beneficial for the building are created. Also, there are installations in the existing urban structure that can positively influence the host environment, whether by expanding space or providing additional design and technology improvements.

Figure 1. (a), (b) The Green Exhibition House, Rotterdam, Korteknie Stuhlmacher Architecten; (c) Manifest Destiny, San Francisco, Mark Reigelman; (d) Cabin, Athens, Panos Dragonas Christopoulou Architects; (e) Homes for the Homeless, London, James Furzer.

Figure 2. (a) Balcony, Zalewski Architecture Group; (b), (c) Hutong Bubble, Beijing, MAD Architects.

Figure 3. (a) One Central Park, Sydney, Australia – Jean Nouvel – Ateliers Jean Nouvel; (b) Vertical Forest Milan, Milan, Italy – Stefano Boeri – Boeri Studio; (c) Green Cast, Odawara-shi, Kanagawa Pref., Japan – Kengo Kuma – Kengo Kuma Associates.
4. Concept of Parasitic Architectural Forms

Parasitic Architectural Forms (PAFs) can be multiple in parallel. It is artificial intelligence in architecture, building biomaterial with genetic and geometric information, architectural constructions, innovative tool, autonomous building process, experimental design, system-platform, product. In simple terms, it is an experimental creation of the design of architectural structures by physics of the environment. Lighting and acoustics shaping the form, temperature created scale, and moisture created a structure of the parasite. Space is undoubtedly the main determining feature of architecture. Space is different from other arts. Architecture can be considered as a tool that is actively incorporating or using environmental elements by dynamic or passive means. Architecture exists only as part of the whole environment. It lives in a complicated relationship with him. In a delicate balance between use and enrichment [2].

PAF is, therefore, a system consisting of three interconnected parts, linked to each other. Triumvirate.

PAF = A.I. + DNA-BIO-MAT + RE.PROD.USE.

4.1. Artificial Intelligence (A.I.)

A software capable of processing incoming information and data using neural networks and thus be able to respond autonomously to evaluate, learn, behave and design. Input information is understood to be the influence of the external environment of factors affecting the host. The result will be parametric information for designing, shaping the resulting shape of architectural structures. Conceptually, the whole process and the functioning of the software is set as a course in three cycles repeated in several sequences until the desired forms of the individual structural-spatial parameters are achieved. In the first cycle (Cycle_NTMY), the software aims at recognising the host and recognising the host environment, i.e. it works with satellite image meteorological data, cadastral data, geographic data, geometric data, various contextual and regulatory information compared to sources of example contents. In the second cycle (Cycle_KREA), the task of the software is to create a 3D model of the host and its virtual reality environment, and this output will be able to undergo simulations of external environmental conditions. The whole process takes place on feedback, communication. The result will be generic information needed to simulate the growth, development and shaping of a 3D parasite model. The processing of such a model of the environment and the host building in question will be ensured solely by autonomous software. We have a massive amount of usable material such as the satellite imagery and Google Maps imagined, and using geometric calculations and projections data on the geometry of apartment houses of standardised construction systems when we are talking, for example, of standardised panel systems as possible, suitable hosts. To bring the whole concept of parasitism to perfection, PAF software (A.I.) will also parasitise on other computational and simulation software in the third cycle (Cycle_VERSUS) and thus undergo the 3D model of the parasite, its critical details and individual parts, verification and assessment. Parameterisation, by its very nature, means using sets of parameters or limits as a means of exploring the possibilities of geometry through multiplication, distortion, transformation, or all three at once. The role of parameterisation, useful for creating daring formal abstractions, is to exceed predictable results based on predetermined input data [2]. Broadly, parametric design can be defined as work that is driven by parameters, where specific sets of rules inform the architectural or design output.
It may be surprising that the digital can be traced back so far in history. In fact, it was argued by some architecture historians to begin in the Renaissance [1].

![Figure 5. Illustration of how PAF A.I. could work.](image)

4.2. Material (DNA-BIO-MAT)

is containing a bio-component and capable of gradually evolving from element to structure, subsequently clumping to the final form. The definition and creation of material are subject to biomimicry observation, study and conceptual material design. I assume that the material could be based on a combination of biopolymers, lichenized concrete and bio cement, which would gradually change from a resilient to a fossilized material structure providing the basis for further growth, while at the same time being able to describe the purpose and needs of PAF best. Biomimicry adepts are Cocollithophores, a type of coral that can convert CO2 into its building material in the marine environment. Furthermore, mucus, Micro-algae, lichens, mosses, punches, stromatolites, succulents, toxoplasmosis, fungi and animal tissues. Biomimicry studies and adaptation of phenomena such as sedimentation, derivatization, diffusion, desertification, crystallization, karst phenomena of coral chemical phenomena, fusing and chemical expansion reactions are also essential. It will be one and the same material applicable anywhere but varied. Diversity, as in nature, will ensure the ability to survive and adapt, thereby always resist the influences and changes of the environment. Differences will have occurred at the level of the climate zone, regional and political geography, settlement structure, urban-type, building-host. The fit systems are described by the contribution of their components to the maximization of different, though generically related, structural forms. In biological structures, the DNA molecule suggests a minimum inventory-maximum diversity principle from a biomechanical interaction point of view. This new materialism appears to have a diverse and complex influence on contemporary design. Historically there are two distinct ways of influencing design. The first quickly absorbing material as a stylistic and formal phenomenon, while the second is more profound in exploring the complex interrelations between science, technology and design that have only begun to emerge [3]. Architecture is part of its environment as a whole. An environmental approach can be developed, given the awareness of the potential dynamic reciprocity between many species and the environment that makes them conditional. Like cell behaviour, the external stimulus partly determines, complementary systems must foster each other based on symbiotic and cyclic relationships to create a sustainable but variable environment [2].

4.3. Process (RE.PROD.USE)

in this concept means the technological action, phenomenon of autonomous growth, application and reproduction by 3D printing technology using robotization. The whole process of material growth will depend on its structure and composition. While I am working with the concept at the moment I can not precisely define and describe the course of the process, but it will be a combination of growth in terms of chemical expansion reactions, reproduction and guidance system of growth by food, possibly degraded older layers that will serve as a substrate absorbed by new layers, generations of this material. Growth as a kind of movement can turn an otherwise mundane and drab architecture into an infinitely complex and vivid [2]. If we consider that growth is to Nature, what production is to Design, then the notion of shaping and making come to include more than a straightforward manifestation of shape. In nature, the form is informed by the interaction of matter and energy. It is due to the distribution of matter and its properties that such interaction is made possible in the physical realm [3]. Resilience and flexibility of the whole model during its lifetime will be ensured by testing already in the phase of
simulating the interaction of external influences on the form and its feedback, thus generating an update of DNA information for further material growth as it will be a life cycle and new generations of material.

5. Biomimicry as a solution
For to transform all these conceptual hypotheses into verifiable theses, biomimicry is the most appropriate approach, taking biomimicry as imitating models, systems, time-tested patterns and strategies from nature, and applying them as solutions to the problems we commonly encounter. The many manifestations in natural organisms provide a rich sourcebook of ideas for structures that could be more efficient than those found in conventional architecture. The principle for architecture that emerges from observing nature is fewer materials, more design. Nature showing us how minimal materials can be used to maximize the effect [4]. For example, Buckminster Fuller explored the dynamics of the form through his synergistic principles. By reducing weight, he sought a structure that he considered minimal but capable of dynamically transforming in response to environmental conditions [2].

Figure 6. Visualisations of Parasitic Architectural Forms at scene.

6. Concept of methodology
The basic idea is to compare the resulting product, which is, in this case, developed artificial intelligence software and bottom-bio-material on contrasting host environments (island-inland, temperate climate-tropical climate zone, urbanism and Europe-Asia culture) with volume and typology comparable hosts. All research should be carried out in the following steps:

- measure values of Barometric Pressure, Temperature, Relative Humidity, Dew Point, Wind speed, Wind direction for 2020 and 2021 in Košice, Taipei (data in situ) and compare with each other and with measured airport's values BTS(Bratislava), KSC(Košice), SLD(Sliač), TAT (Poprad), ILZ (Zilina) - SHMI and data from airports TPE (Taoyuan), KHH (Kaohsiung), RMQ (Taichung), HUN (Hualien), TTT (Taitung) 2010-2021 at half-hour intervals (data) Weather). Define dependencies and determine parameters for parametric design by multicriteria optimization and linear and nonlinear analysis;
- to find a model and principle of functioning and behaviour of selected observed and reference subjects, to adapt biological and behavioural and subsequently to describe and define mathematical (generative geometry) -physical (behaviour) -chemical (composition + structure + behaviour) model;
- creating software PAF A.I.;
7. Enlightenment and challenge

The p-a-f.eu website is also an essential part of the development and works on this topic. Through this analytical-informative website, I try to characterize my ideas, inform about the course of the whole research, find and define a variety of moods and opinions of the professional as well as the lay public as a possible input parameter of the system development. The aim is also to open a forum discussion on the topic. Through the open-call challenge to find possible collaborating collaborators from different industries, with enthusiasm for developing this topic, but also the product itself, thus creating a broad interdisciplinary team. Later in this webspace to offer the finished product as an open-source and help to develop further or eventually transmit the imaginary relay.

8. Conclusion

This paper aims to bring my dissertation topic closer to the professional public, to open a discussion on artificial intelligence in architecture, to explore experimental design methods in architecture, and to adapt futuristic ideas in research and practice. The research and development of this subject is an attempt to partially dehumanize architectural design as an experiment. We have an incredible amount of information and examples in nature, but we do not yet know how to use and process this scarce resource effectively. However, unlike the classical artificial intelligence of the cyber age, today's artificial intelligence does not even try to imitate the logic of the human mind. Conversely, advanced electronic computing can now solve seemingly unsolvable problems, problems that we could not solve otherwise, precisely because computers seem to have developed their logic, their scientific method and their way of thinking, which is quite different like ours. Computers do not think, as we think, because of the simple but drastic structural difference between our mind and theirs: unlike computers, we have never been firmly connected to big data. What we call "big data" today means data too large to be managed, but which computers can manage it without any problems. Buildings designed, calculated and built in this way tend to look very different from everything we have ever designed. They also tend to meet specifications better because, in this spirit, the calculations are ahead of us [5]. Are digital tools that can solve technical problems? Or we can extrapolate their potential to change the way we design, build and inhabit our world for a more sustainable future [1]?

9. References

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