

**TECHNICAL UNIVERSITY OF CLUJ-NAPOCA**

**FACULTY OF ARCHITECTURE AND URBAN PLANNING**

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**PhD Thesis Summary**

**DIGIT\_ALL ARCHITECTURE - about transformations of the architectural author and architectural performance in the digital age**

Keywords - digital, parametric, author, performance, scripting

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## Summary

As the title of the paper betrays, the work is concerned with two major poles of the process started within the architectural profession with the embrace of computer and digital creation techniques. It is about the transformation of the status of the architectural author,

the architect on the one hand, and the architecture itself as object, on the other. From this perspective, the work can be viewed as consisting of two main sections, the first devoted to the author of architecture and the second to the production of architecture.

Although this separation can be read easily by observing the interest clearly displayed in each of the two major parts of the work, in fact, both issues are in strict connection and determine each other. Both the author and the production of architecture are presented as elements of a creative flow and what actually differs in each section of the text is the perspective from which they are examined. The first section, consisting of chapters two and three of the paper, addresses the issue the author of architecture in the digital age in the broader context of the profession. The approach is constructed in close connection to the product and process of architecture and the mutations they suffer in the new digital context. Similarly, the second section, consisting of chapters four and five, brings in the foreground the transformation of the architecture product in the context of the new incarnations of the author and the creative process. The conclusion of the whole work is that the transformation occurs at all levels of the profession. This transformation affects the whole process, virtually reconstructing the basic terms of the architectural creation equation.

In this picture, almost mathematically defined by equations of production and change, central is though a previously unnamed item in this introduction, the architectural tool. The architectural instrument although not directly nominated as the subject of this study, is in fact the turntable and the motivation for the whole text.

The instrument, the architectural tool, is the catalyst of the reciprocal determination between the author and the architectural production, as well as the binder of all the relevant terms in the creation process. For these reasons, the becoming of the architectural instrument in the digital age compels the re-visitation of the definitions for all the other terms of process. They all need to be rebuilt through the rewiring of all the creative and causal connections that determine them. In the two parts of the text, mentioned earlier, the difference in perspective can be translated as a browsing from opposite directions of the determination relationships from inside the architectural process. This browsing allows for a gradual construction of each of the central issues (subjects of the said parts of the paper) and a step by step revelation of the mutations suffered by them through the digitalization of the architectural creation process.

In the case of the author of architecture, the conclusion of the first section of the text is that the transformation is in fact a cleavage. The evolution of the architecture tool and the transformations introduced by this are producing a rupture in the classical statute of the architecture author. The text follows the red thread of the creative decision in reverse to the normal direction of the architectural form production process. The ever more complex architectural production needs ever more powerful instruments who's added intelligence can be understood as latent creativity. This creativity although liberated by a user of cannot be directly attributed him or her. No matter how much importance is given to the creative use of the tool, a fraction of its result is part of the latent creativity induced in it by its creator. For these reasons the architectural authorship in the digital age should be extended to include at least one extra category. This category should hold the creator of intelligent tools that augment and extend the human intellect and creativity.

The whole endeavour of this discovery and determination starts somehow from a rhetorical but legitimate question regarding the destiny of the classical creative professional in the new digital architecture paradigm. The whole text in the subsequent chapters constitutes an answer to this question.

The author, tool, work relationship is sought after and defined firstly through a recourse to history. On the way of the architectural becoming of humanity the nature of the architecture author was in a continuous shift. This change can be compared with the spiral of artistic becoming postulated by Heinrich Wölfflin in the "Principles of Art History". In other

words in addition to the continuously ascending movement, in the case of architectural authorship, a pendulum movement can be identified between the analogue and digital intermediation.

The historical incursion starts from the autographical architecture and the perfect analogy between artistic intent and architectural product. This was specific to the architecture produced directly through the unmediated presence of the architect on the building site and the inexistence of notation. The first move towards the digital is represented by the Renaissance through the theories of Leon Batista Alberti. Those were a veritable pre-incarnation of the digital mentality in architecture, a long time before the birth of its traditional support the computer. This is the moment in time when one can talk about the first rupture between author and work through the legitimation of notation as the original result of architectural design.

Analogue design bounces back in force with the invention of the printing press. The now dominant position of the analogue reproduction of architecture is further reinforced through mass production after the industrial revolution. This deepens the rift between the author and the physical production of architecture as an incarnation of the creative thought.

The comeback of the digital takes place more than five centuries after the digital theories postulated by Alberti and at a theoretical and avant-garde level it represents a cataclysmic event. On the other hand, in every day life, the first real result of the digital architectural instruments was the perfect analogue status between the author's description and the physical result of the architectural work. The event we are talking about is the creation of the first computer aided design system entitled SketchPAD presented by Ivan Sutherland in 1963 at MIT. The change, leaving aside the novelty of the presented instrument, was the new way the author was relating with the creative process and by extension to the produced object. The other result, the one impacting the everyday life of the architecture profession, the one that can't be exactly pinpointed in time is the spread of the CAD instruments in the 80's and 90's mostly towards the benefit of the analogical paradigm of architecture. The preponderant bi-dimensional usage of the CAD instruments mostly as advanced drawing tools meant the perpetuation for a few more decades of the analogue authorship system in place since the creation of the printing press. In this system of thought, the author produces the artefact as architectural notation (just like Alberti was proposing) and third parties devoid of any creative will are then in charge of transposing it into built form. In this way the creative connection between the author and the form remained uninterrupted even if that meant that the original form was tied with the 2d representation of reality on paper. Another transformation in the direction of the perfect analogy between creative will and built form towards the total allography of architecture was the CAD-CAM revolution. The digital control over the physical production of form had as a direct effect the elimination of all the intermediaries from the process of form materialization. The creation and production flux not interrupted nor by the limitations of the material control over the means of design and fabrication, allowed a full tracing of the connection between the creative will of the designer and the existence of architectural form.

The paradox, keeping with the spiral image observed by Wölfflin in art, is that the vehicle used to achieve this peak of analogy between authorial will and architectural shape brings the premises for a new transformation of the paradigm. The technology and the applied mathematics that made the digital notation and the numerical control of machinery possible also brought on changes in the creative flux of architectural design. Through information technology, superior mathematical techniques can be directly applied in the creative process of architecture design thus allowing control of formal universes previously inaccessible. The last decade of the 20<sup>th</sup> century and the first years of the 21<sup>st</sup> are marked by the exuberance associated with those discoveries. The great majority of the enthusiasts of digital architecture by the year 2000 were already committing to the new techniques and associated instruments without giving too much thought to the restriction of the ability to

creatively decide formal outcome of the design. We are talking of course about the Blob Era and the absolute reign of the interface over the design tool. The limits of the ability for creative decision can be observed in the avant-garde architecture productions that tend to gravitate towards the same formal family that encodes the same interpretations of the mathematics of continuity discovered by Leibnitz and Newton three centuries earlier. Beyond the freedom from the yoke of simplicity and the contesting attitude towards the post/modern form, the convergence towards a family of forms in the architecture of the era can be lectured and understood as the abdication in front of a set of similar constraints imposed by the interface and the instrument producing companies.

Simultaneously with the embedding the digital as a representation technique movement, outside the profession a number of currents of thought and production of form begins to coagulate. Those start to question the limited way of relating with the multi-valence of the new digital state of the information. It is a convergence of theories and ideas both old and new that find a new power to come to light in the new informational era. In this respect the text flows with an ever looser relation towards the chronological thread presenting concepts pertaining to philosophy (the objectile, the rhizome, systems theory), industry (mass customisation) or biology (morphogenesis and emergence). The essence of these transformations shifts the focus of creation both in the artistic and the scientific field, from the object towards the process and from the normed multipliable unique towards the multitude individualized in every element.

With some latency the transformations materialize themselves in architecture where the first complete incorporation of the digital paradigm in the major creation flux happens. This is the era of computational design that brings with itself the transformation or better said the fracture of the architectural authorship. The text analyses both the causes of this transformation (be them the evident ones, the instrumental ones or the more subtle systemic ones) and also its effects upon all the terms in the process of creation and production of architecture.

At a causal level the text analyses the ways the new instruments facilitate the architectural form by contributing to the creative ability inside each author. The digital augmentation of the architectural designer's abilities is studied and exemplified at a productive, cognitive and creative level through the lens of the most specific class of instruments from computational design era, the script.

Advancing along the creative flow the most visible and profound effects are analysed and decomposed themselves. Success models like the open-source philosophy, the electronic collaboration platforms or the participative design serve as an illustration for the road taken by the author of architecture, a road not devoid of perils.

The section of the text ends with a number of considerations regarding the actual and future position of the architect as an author of architecture and simultaneously an author of architectural tools. A number of measures are proposed aimed at shortening the transition period architecture is currently in . Also the same measures strive to hasten the process of extending the access to the enhanced creation abilities brought on by the custom digital instruments created on the measure and need of every designer and every project. For this the ability to "write" algorithms and think algorithmically is viewed as essential and as a result its learning as paramount. For this specific reason the architectural education system, usually lagging behind the contemporary architectural practice, needs to regain its habit for leading the pioneering endeavours in challenging the established architecture of the architecture design process.

In the second section of the text the discussion regarding the digital paradigm and its impact in architecture moves into the realm of performance. As a natural continuation of the issues raised in the first chapters, in chapters four and five a theoretical and practical analysis of the effects of the digital transformation of the architectural creation process is conducted.

The goal proposed for the text from the beginning is to demonstrate that the digital becoming of the architecture process is not just the result of a technological leap but more a direct consequence of a latent want of architecture, for a long time present in the collective conscience of the creative profession.

Demonstrating this need requires a new recourse to history. This time the text looks into the history of the notion of performance. The investigation starts from the inception of the notion as a theoretical formulation in dramaturgy, sciences and later on in architecture. Everywhere in explaining the notion of performance related to the world of human creation and production (architectural or otherwise) the focus falls from object to process. In a performative read of the world any individual or object can be defined by his or its capacity for action. This notion, the action, rests at the base of the actor-network theory created by Bruno Latour and Michael Callon. The theory stipulates that every element of the world (living or inanimate) becomes an actor in the network it is part of through its own capacity for action. Starting from this theoretical milestone the text traverses through a number of style periods from architecture's evolution process lecturing them in the key of performance at a practical and also at a theoretical level. The end of the demarche reinforces the idea that the performance of architecture can be truly understood if architecture itself is understood as a process rather than as an object. Towards this end-result remarkable is the definition of performance given by Michael Hensel that affirms that the discovery of performance in architecture means the integrated approach of the architectural object, based on the sum of its relations both planned and unplanned, on the place and scope of the building in the larger context of the environment it resides in.

The connection of performance with digital technology is outlined through browsing and commenting on a number of theoretical texts belonging to some of the most prominent contemporary thinkers in the field. Articles belonging to David Leatherbarrow, Branko Kolarevic or Yasa Grobman cited and distilled to prove the reciprocal determination between the digitally enhanced architectural flux and the much larger access to architecture's performance. Notable is Yassa Grobman's text which considers that performatism and the typical type of thinking associated with the digital are parts of the same paradigm because both rely on the logic of the parameter to be defined. The logic of the parameters is considered to be the same as the logic of architectural performance, because the optimization that rests at the base of performance is structured on the same criteria as the logic of the algorithm. In both cases performance is created by a number of variables that mashed together in an equation produce a result. From an architectural point of view this result can be considered an optima if it satisfies certain fitness criteria as a result of the integrated evaluation process.

Building on this philosophy of the parameter-criterion binomial, the thesis creates a system of decomposition and tracing of the digitally controlled architectural performance principles in the form creation workflow. This taxonomy of the digital architectural performance sets of to explain the mechanisms of architectural performance viewed as object, process and system and their connection with the digital algorithmic way of thinking. More specifically, in a sum of instances of architectural performance a causal connection is sought, between the digital workflow supported by custom software instruments and tangible, quantifiable results of performance. The cataloguing through the lens of the architectural performance criteria proposed in the text make use of three large categories and a number of sub-categories logically and positionally grouped.

The first category holds the performance measured through environmental criteria or criteria considered to be exterior to the architectural object. Here can be assigned the solar, aerodynamical, illumination, ventilation performance and also the performance of architecture in the built environment be it urban or rural.

A second category gathers the interior criteria of architecture, these mean the criteria/parameters that are connected with the user and the use of architecture by said

user. Here are included function, functionality, ergonomics of space and the way architecture stimulates and allows the interaction of the user and among users. Besides these subjective criteria/parameters also appear here criteria measuring the experience of using architecture in an objective way like acoustics or visibility.

The last category includes intrinsic characteristics of architecture like material logic or the physical logic of construction processes in conjunction with the material. A special sub-category in this roster was reserved for structural performance as the engine of architectural form.

For the illustration and explanation of each category the theoretical discussion is always applied to a case study based on an example taken from the contemporary architectural practice. Each example (be it an actual architectural built object or new research with tangible results in the field) is decomposed in the basic element (steps) of the process. This is motivated by an attempt closely related to reverse-engineering to identify and test the algorithmic logic responsible for the architectural result that makes the example stand out. Thus in the majority of cases, together with the actual example the architectural design flux responsible for the result is presented. In each of the examples the typology specific for the digital optimisation is searched. This in almost all of the examples is based on an iterative generation-simulation loop.

Continuing the explanatory process from chapter four, in chapter five the argument shifts towards the specific instruments of the digital architectural performance process. Central to this discussion are the software platforms that enable the construction and customisation of architectural instruments specifically to meet certain criteria or geared towards general improvement. Here, just like in the first section of the text (the one referring to authorship), paramount is the polymorphy of the digital architectural tool and its ability to accept new sequences of code or be assembled together with other tools for the production of new capacities of producing/searching the performance. To highlight this aspect more mentalities of tool building that either include or do without the user input, are compared.

In the last chapter a few own snippets of practical research are presented. All of them are geared in searching or producing architectural performance through the digital manipulation of architectural form. The presented research was directed towards the practical testing of the previously mentioned theories in the body of the thesis as well as on the representation and deeper exemplification of possible workflows and instrumental approaches of architectural performance.

The conclusion of the thesis constitutes a sort of a counterpoint to the general current in the paper, destined to highlight an aspect to little mentioned in the body of the text but nevertheless indirectly implied in almost every paragraph. The interest and the exuberance in embracing the digital in the flux of architectural creation does not come with the cost of renouncing the organic creative abilities of the individual. This only happens through a defective understanding and inhibition of technology and through the limitation of use at the interface veil. Opposing this kind of practices the thesis proposes decomposing the instrument's artificial intelligence to its most basic elements. This allows complete control over the instrument and avoids the deformation of human creativity and the anaesthesia of contentment gained through reaching an apparent peak of architectural performance.

As a direction for the future, the polymorphic abilities of the digital tool built on the contemporary platforms of the computational design era is proposed as a cost effective method (a costless one even) to the development of the Romanian architecture school. Towards this goal the text of the thesis aims to be a framework, an orientation guide and a minimal exemplification of the capacities of design inherent in this kind of approach.