Architecture and Design in the Digital Age

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Abstract. This paper aims to identify the existence of emerging trends in contemporary architecture called digital architecture. Based on the latest literature on the intensive use of Information and Communication Technology (ICT) in Indonesian architectural practices, the article shows how this technology change people's behavior in the past decade has contributed to a real revolution in this field by building a new paradigm of conceptualizing, developing and implementing architectural products. This study used descriptive method to present a complete picture of social settings or intended for exploration and clarification of a phenomenon or social reality by describing a number of variables relating to the problem and the unit under study between the phenomena tested. The result of this study showed the importance of updating project professionals in the field of digital technology and a thorough review of the architecture school curriculum in the sense of removing the applied computer.

1. Introduction
The education field has merged with the digital technology, but the use of it is administratively limited. For example, campus cyber system which is administratively limited is expected to encompasses the ease of learning access, evaluation, academic data access, class schedule, and learning outcome that could be accessed any time. The three main concept of a digital campus are computers, communication (intranet/internet) and content [1]. Good technology is truly transparent to users, which allows users to do everyday tasks without having to master any kind of additional skills that are foreign to someone's specific training profile. However, comfortable conditions that sometimes cover certain roots of transformation are possible precisely with the application of the technology provided [2]. This seems to be a problem with Information and Communication Technology - ICT today, because despite its intensive development and application, it has been applied to all professional categories and society at large. Absorption has occurred so intensely and voluntarily that it can be said that currently ICT absorbs all human activities without the users themselves being aware of it [3].

In such a way, we rarely realize that people's behavior has been reshaped in the light of the new features offered by digital technology, thus embodying some of the boldest prophecies that prominent researchers have established between the 1980s and 1990s in trying to decipher new paradigms that ICT intensive applications for everyday tasks begin to show. However, it never hurts to reclaim memories of some of these transitions to better understand the present and allow prospective customers for future trends [4]. In this case, the first of these transitions, which form the basis of everything else, concerns the migration of information from material media to its digital form, incorporating in this process the full potential of new technology [5]. Once digital, information becomes accessible to anyone with a telephone line and internet connection from anywhere. This means the possibility of access to remote,
synchronous or asynchronous services, independent direct contact, such as e-mail, an electronic correspondence system that has increased the possibility of asynchronous communication, allows messages to be sent and received at any time without real-time interaction between the sender and recipient. But all in a much faster time and through a mode of operation that is far simpler than traditional letters [6]. It is surprising that in a little time more than ten years formed by networked computers and networked computers [7,8]. Cyberspace is able to occupy such a significant space in our daily lives, realizing the interesting analogy proposed by this researcher who imagines parallels between real urban scenarios and possible Digital Agora, where urban functions will be implemented virtually, even with real results on the ground. It concentrates certain activities that are fundamental to the functioning of the global economy without anyone else being aware of it [9-11].

The purpose of this research is to find out the information process in Architecture in developing designs in the digital age using technology. But it is not just about the process of information exchange and trade and distribution of commodities provided by ICTs from cyberspace and continues to provide a paradigm gap. This study used descriptive method to present a complete picture of social settings or intended for exploration and clarification of a phenomenon or social reality.

2. Method
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3. Results and Discussion
New architecture arose from the digital revolution, finding its expression in the form of highly complex curves that were gradually incorporated into major trends. from non-Euclidean geometric spaces, kinetic and dynamic systems, and generative form algorithms beyond traditional architectural patterns, helped by the incorporation of progress already made in the automotive, aerospace and navigation industries. In particular, the possibility of integrating the CAD system with the CAM system, which has enabled the production and construction of very complex forms which until now has been practically unusable in terms of cost and production. Created ten years after the City of Bits: while traditional architecture is the embodiment of drawings made on paper, contemporary architecture is the embodiment of digital techniques that allow the design of objects with a level of complexity that is high [5].

Therefore, the initial stage of simply replacing the traditional architectural project development resources with computing resources - from analog boards to digital boards - has been overcome, and given the continuous evolution of ICTs, which have been available to architects of various resources and are not publicized, possibilities that go far beyond the creative movement, we will then face new trends that will enable us to speak, in "Digital Architecture", towards an unprecedented methodology, based on an exclusive body of theory, culture and practice, supported by new technology. and is able to produce an object category that is unprecedented. However, change is not always visible to all those involved in the conception and production of contemporary architecture, even if they are regular users of digital technology, because, outside of the instrumentals, this change is in accordance with the great paradigmatic leaps that result from epistemological changes, . which imposes conceptual revisions, rather than training in new representation techniques. As communication and long-distance communication are not synchronized, it is not only the possibility of using it, but the methods used that produce paradigm changes.

In fact, an obsessive search for (modulor) and normative patterns capable of supporting the repetition and reproduction processes that underlie the Industrialization Mechanization Age, has been replaced, in the First Digital Age, by new capacities. technology to propose important alternatives to the creative process and not just by improving the previous process, based on other logic[8]. In his view, while the obsession with repetitive modulation reflects a search for a stable environment, contemporary production represents a dynamic and constantly changing world with additional variations: challenges
to the static logic of normalization and strict typology, which propose diversity, discontinuity, differentiation, and dynamic evolution that is intended to be more than just formalism and can then be understood as a new symbiosis between products, projects, and ways of fertilization, development, and production through digital resources.

Oxman understands that digital technology has freed the image of traditional representational concepts and forms are no longer represented in conventional ways based on static space parameters created by paper, because new concepts of space and dynamic forms have been introduced. Interactive projects that produce new project categories that are always and exclusively feasible through Information and Communication Technology and, therefore, must be defined as "Digital Projects" or, in a broader concept, as "Digital Architecture". For example, he referred to Frank Gehry's Guggenheim Museum in Bilbao, classifying it as a synthesis of new ways of thinking about the clearest and most recognized forms, looking for new design methods, including digital technology (Figure 1).

![Figure 1. Museu Guggenheim](image1.jpg)

It also cites the Waterloo International Station in London, designed by Nicholas Grimshaw, characterizes it as one of the first examples of non-repeatable proposals that use parametric design techniques to determine the curvilinear shape of its glass façade (Figure 2).

![Figure 2. Museu Guggenheim, detalhe da cobertura e fachada.](image2.jpg)

And found in the Yokahama International Harbor Terminal Architect Project project (Farshid Moussavi and Alejandro Zaera Pole, 1995) case studies of formal complexity, including an emphasis on so-called hyper continuity, or high-end models. topographic complexity, practically impossible before the digital age (Figure 3).
Is it possible, then, to build a theoretical model that will allow the classification of trends, to facilitate an understanding of the emerging "Digital Architecture"? Once again helps by proposing the following paradigmatic models:

- **CAD systems**, the first step towards solving with conventional paper designs, but with little initial effect on the design process;
- "Formation", a concept formed from emerging design theories that transforms the concept of form into a composition concept related to topology (which explores the concepts of formal topology and non-Euclidean geometry), parameterization and animation (morphological and morphological transformations). Other traits, which multiply non-continuously on a dynamic continuum);
- **Generations**: are characterized by the supply of computational mechanisms by generative processes, where forms are defined from predetermined generative formulas. Here you can specify two subgroups, the grammatical form, and the evolution model;
- **Performance**, determined by performance and potential integrated with the process of forming and generating external external determinants such as environmental issues, site characteristics, programs, etc.

The theoretical model, therefore, consists of four categories, defined according to digital techniques and / or processes used in the design of architectural products. The first category, CAD Systems, is simply a record of migration from traditional architecture to the digital environment, when new technology practically imitates the practice of drawing boards, automatically automating certain routines, thereby, of course, contributing to changes in the development process, but with almost zero rebound in formal results;

Then, the "Formation" category, one step further, uses unorthodox formal composition tools, embedded in or added to CAD systems - such as plug-ins - always associated with visual processing of forms. The next category, Generations, while formal composition processes, are intrinsic, non-visualization methods supported by the processing power of digital technology. The algorithm is proposed and, from it, the computer generates a form. Algorithms that may be random or based on rules are defined from cultural, sociological, or other characteristics. In this case it is defined as "form-grammar", that is, formal grammar (rules). The Institute of Higher Engineering Technical University of Lisbon, entitled The Grammar for the Patio Houses of Medina of Marrakech, presented at eCAADe 2006 in Volos, Greece, which is from the development of the model digital Medina Marrakech in Morocco, has extracted several distinctive features ("grammar rules") that determine the urban structure of traditional Muslim cities for applications in contemporary urban aircraft. A very interesting work which proposes "grammar" to describe the formal structure of a house determined by the laws of the Koran, thus enabling the reproduction of their future, from the generative process. And finally, the Performance category, which relies heavily on digital simulation models that guide project definitions.
and can prove their suitability for certain prerequisites stemming from problems outside the formal composition itself [1]. In this case, it was a simulation of the occupation of a large city space, as a result of the construction of a new building for the Stuttgart train station which, located at the bottom of a valley and surrounded by plateaus, was experiencing serious problems, with air pollution, especially during times of thermal inversion, resulting in very strict city laws regarding the height and orientation of buildings, so that they do not obstruct the air circulation that is needed in the city.

Thus, the researchers sought to verify, through virtual and interactive simulations, the various possibilities of occupation of this new area that would be available for real estate investment, evaluating positive or negative effects to the city from possible developments in these locations. As we see from this Theoretical Model, "Digital Architecture" that emerges far beyond cues, a simple sketch that expresses the formal synthesis of an idea, or, repeating Mitchel, is actually an embodiment of digital techniques that allow the design of objects with a high degree of complexity. In fact, after more than thirty years of technological progress and paradigm changes as a result of the Atelier Design practice, the profile of this contemporary architect goes far beyond synthesizing the movement toward a strong background in digital technology.

The evolution of the profession in the past 20 years, dividing periods into stages related to the characteristics of digital technology available in each period. As such, he places the 1980s 85th as the final moment of traditional design, and refers to the 1990s as an era of growth and expansion of CAD systems, where handmade drawings migrate. It also identifies, currently, the emergence of the Internet, citing several attempts to exchange information through this media among project teams. From 2000 to 2005 Penttila identified the growth and widespread use of the Internet as a work tool, enabling web-based project activities such as remote collaborative work and highlighting the emergence of BIM - Building Model Modeling technology, which allows linking attributes to objects represented in the project, thus enabling management they at various levels of information are possible from automatic extraction of cuts and heights, to the publication of reports with quantitative tables, all automatically updated of any changes that occur. produce at every level of information the objects that make up the project.

Impressed, then, by the intensity of the flow of digital information flowing through the design of the project, under the responsibility of the architect, Pentilla concluded that contemporary professionals must, above all, an excellent communicator and coordinator, be able to deal with most digital communication equipment and applications that owned today and at the same time can coordinate the flow of all this information, which often occurs asynchronously and remotely. In short, a professional with a broad multidisciplinary background who has characterized architects since ancient times, but now with a strong background in digital technology. Contingencies that require revision of the training process of project professionals, in order to truly enable them to face the challenges of this emerging trend, reevaluate the current school curriculum.

The curriculum, according to research conducted about two years ago is still largely oriented towards teaching applied informatics as a mere accessory to the final representation process of an architectural project, apart from some more advanced initiatives. It is therefore urgent to go further, because the architect of the digital age can no longer be understood only as a professional who is able to make creative sketches that synthesize formal thought.

4. Conclusion
The possibility of formal conceptions offered by digital technology has encouraged architects to look for new ways to apply this technology that has determined the paradigmatic leap in relation to traditional methodologies. As exclusive products of digital technology, they determine a new trend called "Digital Architecture" in four categories according to the digital techniques and/or processes used in the design
of architectural products. We have seen, then, that digital techniques and processes that define these categories are, in fact, technological resources that go far beyond the formal representation process of simple ideas, which involve solid objects. Computer skills, including application programming, to determine the algorithms that can produce shapes. Therefore, the future of this emerging architecture through a review of contemporary architect profiles makes urgency the retraining of professionals who have graduated, as well as the revision of the current curriculum of architecture schools.

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