The Effect of Computational Technology on Architecture

Introduction

Humans gained the ability to calculate and do several difficult activities simultaneously after the introduction of computers. Technology has helped bring the entire globe within our reach via the Internet in the twenty-first century. The usage of computers has had a significant impact on architecture, and computational design refers to the use of computers that use certain algorithms. We can use a mathematical technique to generate complicated geometry and so play with probability using parameters and restrictions through computational design. It was not easy to integrate "new technologies" into architectural education and practise. The term's meaning is uncertain, and it's frequently condensed to something far too simplistic for computer use, or, more simply, for CAD software use. The topic, predictably, divides teachers and professionals, prompting many to take extreme viewpoints. On the one hand, there are people who believe the computer should play a prominent role; on the other hand, there are those who refuse to believe she could play any role at all. However, reality demonstrates that the computer's role can aid in the solution of some design challenges while jeopardizing the solution of others. Because difficulties can be classified with time and expertise, architecture students should be exposed to new technologies early in their learning and training. Advances in ICT have an impact on a building's full life cycle, not just from a practical and technological standpoint, but also from the one of creative design and embodiment. The development of spatial modelling and modelling approaches has enabled architects to work with models that could previously only be sketched or produced using non-standard engineering and construction procedures.

As a result, new technologies and approaches to design and production, such as modular design approaches, performance-based design approaches, and digital manufacturing processes, must be explored and used. Parametric design allows for the study of different designs within a single representation by controlling the engineering and structural components of the design with parameters and associative relationships. Performance targets are developed explicitly in relation to many factors, such as comfort and structure, and updated during design, reviewed, and guarded throughout the design process in performance-based design.

Digital fabrication allows for the investigation of novel design via physical models during the design process, as well as the mass customization of non-standard architecture for cost-effective manufacture. The MSc in Computational Design and Manufacturing Methodologies in Architecture teaches advanced design techniques, new design tools, and new design paradigms in architecture.

Objectives:

(1) Clarifying the computational technology in definition

(2) Comparing between the traditional way and the new technologies

(3) The effect of computational technology on architecture

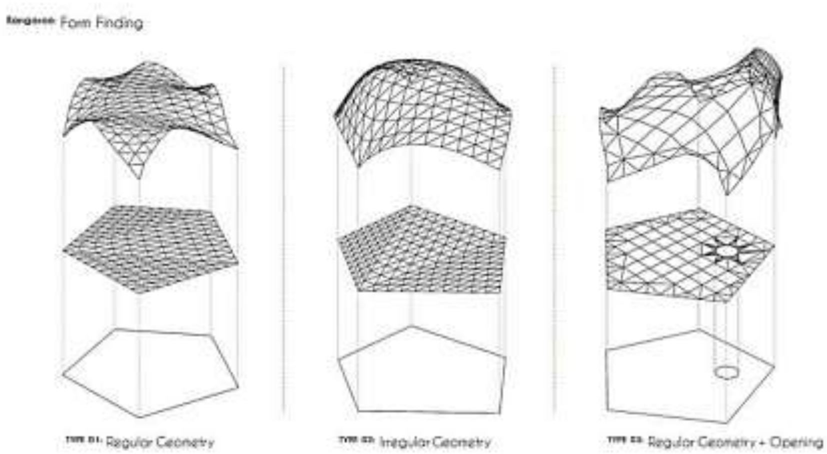
Goals:

1. Collect and trace the evolution of computational technology
2. Applying the new computational technologies on architecture
3. Identify the most relevant CD terms

1. Precise drafting and better representations of AR/VR | Computational Architecture

In the traditional technique of tackling a job, writing and creating building plans takes up a large amount of time. (Celani, 2007) Many of the plans and details for a huge project are handcrafted, which necessitates vast studios and a large number of painters with the necessary time and resources. With the advancement of computer drafting software, it is now possible to quickly write and execute repetitive operations with only a few clicks, saving a significant amount of time, space, and energy. (Caldas & & Duarte, 2005)

3D modelling and visualization software have become increasingly crucial as computation in the area of architecture has progressed. Architectural representation has progressed beyond 3D models and sceneries to include virtual reality and augmented reality technology. (Chen, et al., 1994) It aided architects and visualizers in improving their presentations, as well as the client in better interacting with the space he desired. (Duarte, Caldas, & Rocha, 2004)



2. Creation of spectrum of possibilities using algorithms

A computer is a machine that understands machine language, and software developers assist in the coding or tuning of a machine's algorithm so that any human can interact with it in human language instead of 0 and 1. As a result, a unique circumstance exists. (Towards the Mass Customization of Housing: the grammar of Siza's houses at Malagueira, 2005)

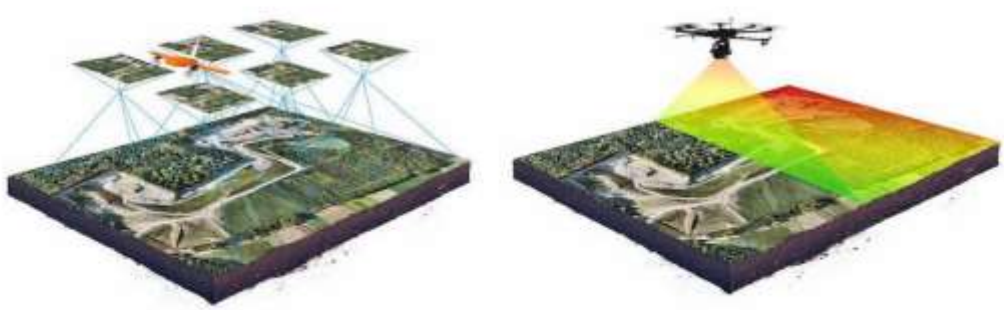
Algorithms and coding can aid in the development of the desired outcomes. Based on the available characteristics and limits, this technique of thinking and designing in the computer aids in the development of numerous alternative shapes. As a result, one can create artistically sophisticated shapes that can also be manufactured digitally. (Chen, et al., 1994) (Duarte, Caldas, & Rocha, 2004)

3. Ease of documentation at various levels | Computational Design

The project should be adequately documented so that mistakes can be learned from, project information can be referred to if needed, and project maintenance can be assisted. The project information can be stored in a standard directory and found in a well-ordered manner with the assistance of calculation. (Caldas & & Duarte, 2005)

4. 3D printing at various scales

One of the most common applications of 3D modelling is 3D printing. 3D printers can model shapes and models that are impossible to design by hand with a single click. 3D printing is currently widely employed in architecture on a variety of scales and in a variety of sectors. 3D printing has aided in the construction of experimental constructions, fittings, and residences, among other things. In the sector of architectural construction, 3D printing is still in its early stages, and only a few companies have begun to employ it. (Celani, 2007)



5. 3D scanning and ease in surveying | Computational Architecture

Surveying the land and terrain for the construction site is an important process that must be completed. With the use of 3D scanning and image technologies, it is possible to obtain more precise scanning data while also carrying more information. There may be a lot of inaccuracies due to bad weather conditions or highly rugged terrain, but a site survey can be done accurately with the help of AI-equipped drones. (Chen, et al., 1994)

6. BIM integration

Building Information Modeling (BIM) is a process that differs from traditional building methods. It is more efficient and aids in the improvement of communication between the various field specialists and the client. The computer is critical in integrating all work, communication, and documentation at the same time. The computer also aids in the synchronization of field work with the project timetable. (Duarte, Caldas, & Rocha, 2004)

7. Enable different types of Simulations | Computational Design

Simulation is a powerful tool for analyzing and improving designs. We are working on a variety of simulations, including structural simulations, wind tunnel simulations, earthquake simulations, green building simulations, and energy simulations, among others. Structural engineers use structural simulations to examine the loads on each building member and determine which ones are due to design errors. Energy simulation is utilized to validate thermal information about the building on site, whereas wind tunnel simulation is used to check air pockets formed at high elevations for skyscrapers and green buildings. This information aids designers in developing effective solutions and resolving issues prior to construction. (Towards the Mass Customization of Housing: the grammar of Siza’s houses at Malagueira, 2005)

8. Better project management system and risk analysis

Project management and scheduling software is critical for keeping track of progress and staying on track with a previously established timetable. A computer can also be used to estimate building expenses and identify potential risks prior to construction. (Celani, 2007) (Caldas & & Duarte, 2005)

9. Introducing robots and AI in architecture | Computational Design

Robotics and artificial intelligence (AI) are relatively new to architecture, however they are still in the early stages of development. As we live with these technologies, we see many different types of robots and AI-based systems. Robotic arms are used for 3D printing and model manufacturing, and they employ artificial intelligence to produce high-quality, error-free designs in less time. (Celani, 2007)

10. Intelligent Building Management Systems | Computational Architecture

In order to manage building service systems, energy consumption, and other aspects of the building, intelligent building management systems are frequently utilized in skyscrapers and high-rise flats. This technology makes the building more sustainable, lowers maintenance expenses, and improves the building user's lifestyle. (Caldas & & Duarte, 2005)

- **CD in architecture**

Computers have been referred to by a variety of words, including numeric, arithmetic, and algorithm. When designers first started using computers in their work, the various applications were dubbed digital design (DD), CD, computational design (AD), and so on. However, there was some overlap and uncertainty, which we now plan to address. As a result, we can start to identify CD from DD. We define DD as the use of computer tools in the design process, whereas CD refers to the development of designs using arithmetic. CD is orthogonal to DD in this sense, in that we can have a CD without utilizing digital tools, or we can use digital tools without using CD, or we can have both. Frei Otto's Surface Minimum Experiments (Otto and Rasch, 1996), which used analogue arithmetic, are an example of a non-DD CD. DD that is not a CD, on the other hand, is the straightforward use of a CAD tool as a drafting device without explicitly employing arithmetic. Finally, an example of DD and CD is Mark Burry's work on the Sagrada Familia (Burry, 1993). This paper focuses on CD and various words associated with it. We develop a detailed description of CD in this section. (Duarte, Caldas, & Rocha, 2004)

Before structuring a taxonomy of CD terms,

b. An induction, that is, extrapolating the required design process to obtain a specific result.

c. An abstraction that, understands the essential design features by removing irrelevant information.

2. Parallelizing design tasks and efficiently managing large amounts of information.

3. Incorporating and propagating changes in a quick and flexible manner.

4. Assisting designers in form-finding processes through automated feedback, such as mapping simulation results.

- **CD terms**

Architects have embraced the CD model as a tool to improve traditional design workflows and pursue other research topics throughout the last two decades. CD typically necessitates specialized knowledge, forcing designers to learn new skills from other industries. (Caldas & & Duarte, 2005) The subsequent fusions of fields resulted in new design methodologies and models, as well as new nomenclature. Some of these terms have a hazy definition, embrace two or more competing viewpoints, or overlap with other concepts. (Celani, 2007) (Duarte, Caldas, & Rocha, 2004)

Conclusion

The meaning of the term itself is ambiguous and tends to be shortened in a way that is too simplistic for computer use or, more simply, to the use of CAD software. Not surprisingly, the issue divides teachers and professionals alike and urges them to take extreme positions. On the one hand, one finds those who tend to assign a central role to the computer; On the other hand, one encounters those who refuse to admit that she could have any role at all. However, reality demonstrates that the computer's role can aid in the solution of some design challenges while jeopardizing the solution of others. Because difficulties can be classified with time and expertise, architecture students should be exposed to new technologies early in their learning and training.The application architecture's application components are connected to the technology components, which include software and hardware components, by technology architecture. Its components are commonly available on the market and can be integrated and customized to form the company's technical infrastructure. The technology architecture depicts how the application components will be realized and delivered in a more realistic manner. It allows for the analysis of migration issues that may arise between different stages of the IS development path. (Towards the Mass Customization of Housing: the grammar of Siza’s houses at Malagueira, 2005) It allows for a more precise assessment of responses to IS restrictions (non-functional requirements), such as predicting hardware and network size requirements or setting up a server or backup storage. The technological architecture focuses on logistical and location challenges such as device location, information system management capabilities, and the locations where different portions of the information system are employed. The technology design also ensures that the application components offered operate together, providing the necessary business integration support. (Duarte, Caldas, & Rocha, 2004).

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