Experiential Design – Rethinking relations between people, objects and environments

Florida State University, AMPS, Architecture_MPS
Tallahassee, Florida: 16-17 January, 2020

MODELMAKING IN ARCHITECTURAL SPACE PRODUCTION: STUDIO INTERACTIONS IN THE MATERIAL AND THE DIGITAL REALM.

Author:

DR ATHENA MOUSTAKA

Institution:

SALFORD UNIVERSITY

INTRODUCTION

This paper will question and reposition what traditional model making practices in architectural education have enabled and how the transition to digital model making ultimately also means a paradigm shift in the ways we produce, manufacture, design, use and experience architecture. To do so, I will argue that the shift that has taken place in architectural production from physical model making to using digital means of fabrication has not only created a shift in the way architecture is produced but also a shift in the type of architecture produced.

I begin by arguing that the change of medium from the physicality of a material to the terrain of a virtual environment, is at first glance a simple change of medium, a change in the tools and techniques used. But because it involves a different type of interaction, a different effect is produced. The paper investigates examples from student work and concludes that the physical handling of matter informs the development of ideas in architectural and design education in a different way than the engagement with a digital tool because of the different experience the software affords and because of the different embodied experience that an object's materiality offers.

FROM MANUAL TO ALGORITHMIC PRODUCTION: THE FOUR DIFFERENT PHILOSOPHIES OF DESIGN

The move from manual to the digital in architecture, since the early 90s, has effected a drastic change in the tools used in architectural production and representation[1]. Various versions of Autodesk software, (i.e. AutoCAD Architectural Desktop 1998-2006), ArchiCAD, and Revit currently include ready-made components to be used in the process of design. Other software, such as Grasshopper and Dynamo require the designer to programme in their interface by imputing parameters. The philosophy of the produced design when using these different pieces of software, is not simply a difference in the interface used. There is a fundamental difference when a designer is dealing with a pre-determined number of components that are pre-existing in a computer, compared to having to create components, or representations of them that are not pre-existing in a software. In the case of the pre-existing components, a user has very little control over these, and the decision of which features to include in a design, starts from these components. In other cases, the user has an apparent freedom to design a new

component by inputting new information but the way this information is input is still relying on a software developer to have predetermined the ways it can be created, and the relationships the different types of information that are allowed by the software still are part of the produced output.

Manual design production

Although the introduction of digital tools revolutionised architectural drawing, the shift in architectural production from the physical to the virtual has not always involved a major shift in the attitude to design. For example, drawing on 2D AutoCAD in the early 90's involved using commands that needed to be typed, and coordinates were inserted manually in the software. The production of the 2D drawing on AutoCAD during its early days was a simple change in medium, not a changing shift: instead of using pen and paper there was a simple transition to keyboard and screen. The ways of organising a 2D drawing were the same, but the tool changed. Of course, with this transition came a visual shift in the outputs produced, but the logic of drawing remained the same: Plotting a drawing (instead of drafting it on a drawing board), still required a calculation of how to centre the layout, identifying the appropriate scale to make your drawing fit the page or the other way around to find what page size you would use to fit your drawing at your desired scale.

The rationale of creating a drawing in this way was shared by drawing board and computer users. While the produced outcomes had slightly different graphic qualities and the production in the one involved a plotter, the actions of creating a drawing between the two methods was not far apart: it required a similar type of thinking and a similar process. Physical tools that had previously been used were replaced by commands: the rapidograph was replaced by the command "line", the tracing paper was replaced by "copyclip", the compass and French curve by "circle" and "arc" respectively. This was therefore a simple swapping of tools, not a ground-breaking shift in the methods used in architectural production, and can all fall under the umbrella category of "Manual Design Production" as presented in table 1.

Design with components

The move, however, to architectural creation in a 3D environment, where the user is interacting with a software to simultaneously visualise and create (create a space, create a building, or create an environment for an activity for a user), marks a shift in the way design is produced. This shift in the entire approach to design, originally took place when 3D design started developing from a set of ready-made components. Software like Architectural Desktop and ArchiCAD introduced this move to designing with components. Every object, library, component in these pieces of software was pre-determined, and the designer had to rely on what was available to work with in order to create a design. It marked the first point of taking away some of the agency of the designer[2].

Components that were not ready made, were very difficult for a software user to input or create from scratch and required a very experienced software user. Hence, design ideas that were not possible to be visualised through the objects/libraries or components already included in software had to be abandoned in favour of ones that pre-existed, leading to "design with components" (Table 1). The emerging design result from using these software is therefore an outcome of the pre-existing versions of the objects that are already included and have been placed there by a software developer. The degree of personal input is limited by the choices made by a developer to include or not a component.

The agency therefore, software developers have over the creation of a design is not to be underestimated. A choice made for example somewhere in Autodesk's offices in Massachusetts or California, informs what a designer is attempting to produce in Japan or England. The genealogy of

decisions from example about a wall that is designed by an architect in India, may be traced back to a desk in San Francisco. Some of the creative actions of design are delegated to the machine.

De Novo 3D design

This deterministic effect of component designed architectures was not as evident in other software such as 3D AutoCAD, and in dynamic modelling 3D software, such as Rhino and 3D Studio Max. For a designer, 3D Studio Max opened a world of modelling possibilities to a designer and enabled a myriad more ideas to be designed on the computer. They also had the ability to simultaneously move the designed object in space while designing. The effect a gesture made for example, in a building's elevation, was simultaneously evident in its plan and section. This type of approach was similar to producing a design through physical modelmaking. In the same way that an architecture student could manipulate a physical object to create a design, these software programmes enabled the user to visualise the effects of design gestures simultaneously in 3D. The cardboard and pen knife for example of physical modelmaking was replaced by the creation of a plane that represented a wall in 3D. Similar to how a designer would create a wall in the working model to understand its effects in space and enable him to visualise its extensive properties, the 3D wall on this software could also visualise this on the computer. The designed object was created "De Novo" (Table 1), without predetermined software effects, with the designers retaining their agency on the designed outcome. Dynamic software however, were introducing another form of computer determined architecture. Because the dynamic modelling capabilities were also decided by software development, they had the capability to model dynamically effects of movement, explosions, interactions of objects and perform calculations applying the laws of physics on the object modelled, but only based on how these options for dynamic modelling had been introduced in the software.

Algorithmic Design

More recently, design software has seen another change in its attitude as it can be produced through code writing in Grasshopper and Dynamo. A designer using these softwares is the author of the information input that will shape the design outcome, but is reliant on a programmer to be able to produce relationships between the types of information included. The designed outcomes of the software is often comes as a surprise the input is in the form of information and the output is authored by the machine.

MANUAL AND SOFTWARE USES IN THE DESIGN STUDIO

An environment that offers the ideal context in which to study the effects of the move from the manual to the digital, is the architecture design studio of architectural schools. Studying how emerging architects learn how to produce designs can help identify how different design philosophies affect the outcomes of design for students. This paper, presents observations following a semester-long teaching of two cohorts studying architectural design: one studying Architecture and Architectural Design and Technology.

The two groups were running in parallel at the same university, and their design studio was led by the author in both cases. Two distinct pedagogical approaches have been followed for each cohort: the first one (BSc Architecture, first year) was asked to design solely using sketching and manual methods of model making, without having any knowledge on how to design on the computer. The second one (BSc Architectural Design and Technology-ADT-, first year) was learning how to model in 3D on

Revit, while they were expected to deliver their designs, so they had to develop their design while learning how to use the software. In the beginning of term, the open-endedness of design outputs was emphasised to both cohorts, giving them the option to develop in any which way possible and very limited constraints were posed in both briefs. Frequently, during the tutorial sessions, it was emphasised to students that everybody can and does design. They were asked to use exclusively a digital model where they needed and to refrain from producing physical models. Both have been taught in the same year and all students involved were first year students, with either minimal or no prior experience in the designing. This means that they were learning to design almost from scratch. While this sounds as a challenge. It presents the opportunity to an instructor to guide the student through different approaches to design.
Observing the first cohort of BSc Architecture students in their modelmaking process, it is evident that physical modelmaking, provides them with an experience that is tactile as much as it is visual. This tactility, however, disappears in the case of BSc ADT students when they are engaging solely in digital modelmaking: Digital models do not allow them to perceive space through any form of embodiment. The tactile experience of designing through a model that is omnipresent in physical modelmaking, has disappeared when using the computer, making the experience a purely visual one.

More specifically, the second cohort, the BSc ADT students trained exclusively in Revit, displayed some common characteristics. Firstly, because of the students little prior ability to use the tool, they run the risk of creating spaces non-intentionally (or incidentally). It was common to propose spaces created with no purpose, simply because the software made easy for them to place a pre-determined component in a particular space. In several cases, spaces had started with a different intention but ended as something else because of the abilities of the software. Similarly, predetermined material choices, were often used because it was part of the default setting on Revit. The pre-existence of a specification was replacing an informed material choices. These materials were often also used in their predetermined state in terms of patterns, regardless of scale, and bearing little relationship to context.
Secondly, the students revealed a far greater level of empathy, both in understanding how these spaces were to be used, and also demonstrated by the absence of any human presence in the representations of their designs. Furthermore, physical models allow architects to view inside them in different ways, either by naked eye or a modeloscope. Being able to understand the building through the physicality of a model makes the experience a fully embodied and three dimensional one, something that is lost in the digital, since the only way to understand is through a two-dimensional screen. Even when the object designed in a virtual environment is in the third dimension, it is experienced in a domain where it feels artificial, and two dimensional. Juanni Pallasmaa refers to this ability of the architect as empathy. In his words: "*architectural ideas and aspirations emerge as immaterial feelings of the designer*"[3]. If this empathy is formed in the architect's imagination through the development process, then the means by which space is understood and envisaged becomes very important for the outcome.

The same author describes how architectural qualities are made in a building: "*True qualities of architecture are* […] *existential, embodied and emotional experiences, and they arise from the individual's existential encounter with the material work*."[4] .For Pallasmaa, the term "*material work*" refers to everyday encounters of an architect with the physicality of the built environment. But if we are to assume that architectural imaginary is formed during the material confrontations of a designer, then it is also very likely to be produced in the very object that assist a designer develop a space. This

is why the physicality of the model becomes important: a digital vs a physical model creates two different types of encounters.

As presented in the ethnographical accounts of Albena Yaneva, the physical manipulation of architectural models is a reciprocal interaction involving the designer, and the object. She presents, through her work on OMA, the way architects rotate, look into, tactile and imagine through models.[5] Yaneva calls this interaction a dance[6]. A similar ethnographic observation of architectural production in the studio, reveals similar outcomes: it is a holistic experience that involves a range of materials used and a range of actions performed. Through this process, a student develops the ability to know exactly how much pressure to exert on the cutting knife, to cut through his 3mm cardboard, what type of glue and the quantity needed for the type of connection he wants to create. Yaneva calls this process of continuously being transported from the physical model to the imaginary potential it offers, a rhythm- she does not see it as a linear process that architects follow to arrive to the building as a "known", but a continuous dialogue between architects, materials and shapes. Within these dialogues, Yaneva claims that there is continuous movement between what is "less known" and more known in buildings, and this movement is continuous and non-linear.[7]

Manual Design	Designing Through Components	De Novo 3D Design	Algorithmic design
• Manual Drafting • 2D AutoCAD	• Architectural Desktop • ArchiCAD • Revit	• 3D Max • Rhino • Physical Modelmaking	• Grasshopper • Dynamo

Table 1. The shift from analogue to digital drawing: Production methods of design.

CONCLUSIONS

The process of design materialises differently in physical model making compared to digitally produced models because it involves an embodied and empathic interaction with the physicality of the design process, something that the digital does not allow. The designer makes choices based on his empathic understanding of future users, sometimes in ways the users themselves never even realised. With the physical modelling process, the architect develops an affinity to the client, becoming able to materialise his client's needs and desires. To borrow a quote from the British architect Sir Denys Lasdun an architect needs to provide to their client: '*not what the client thought he wanted but what he never could have imagined existed*'.[8]

The new generation of architects are moving towards the production of spaces that are not designed empathically and emerging designers are becoming void of an ability to relate to their users. Their sentient ability to connect to others becomes less and less necessary as the design moves to ready-made environments and further into a design where the machine claims significant authorship of the produced outcome. The question that remains from this observation is what this means for the cities of our future, if they are to be designed by a less empathic designer. Are we moving towards a future of the built environment that is less and less accommodating to the desires and needs of a user? The question of how this shift is transforming the built environment and the ways we will be living in it in the future requires further exploration.

[1] Antoine Picon, *Digital Culture in Architecture: An Introduction for the Design Professions* (Basel: Birkhäuser, 2010), 69-71; Antoine Picon, 'From Ownership to Authorship A Historical Perspective', *AD Architectural Design* 86, no. 5 (2016): 37-38.
[2] Stephen Paul Coates, Ali Rachid, and Sara Biscaya, 'The Utilization of BIM to Achieve Prescribed Undergraduate Learning Outcomes,' *8th Annual International Conference on Architecture,* (Athens: 2018).
[3] Juhani Pallasmaa; Harry Francis Mallgrave; Sara Robinson; Vittorio Gallese, '*Architecture and Empathy'*. (Finland: Tapio Wirkkala Rut Bryk Foundation, 2015), 11.
[4] Juhani Pallasmaa, 'Empathic Imagination: Formal and Experiential Projection' *Architectural Design* 84, no. 5 (2014): 82.
[5] Albena Yaneva, 'Scaling Up and Down: Extraction Trials in Architectural Design,' *Social Studies of Science* 35, no. 6 (2005): 870.
[6] Albena Yaneva, *Made by the Office for Metropolitan Architecture: An Ethnography of Design*. (Rotterdam: 010 Publishers, 2009), 51.
[7] Albena Yaneva, 'Scaling Up and Down: Extraction Trials in Architectural Design,' *Social Studies of Science* 35, no. 6 (2005): 874.
[8] James Lasdyn, 'The Master Builder,' *The Guardian*, 29 November (2003): https://www.theguardian.com/artanddesign/2003/nov/29/architecture.art.

–

REFERENCES

Coates, Stephen Paul; Rachid, Ali and Biscaya, Sara. 'The Utilization of BIM to Achieve Prescribed Undergraduate Learning Outcomes', *8th Annual International Conference on Architecture*, Athens: 2018.

Lasdyn, Denys. 'The Master Builder'. *The Guardian*, 29 November (2003), https://www.theguardian.com/artanddesign/2003/nov/29/architecture.art.

Pallasmaa, Juhani. 'Empathic Imagination: Formal and Experiential Projection'. *Architectural Design* 84, no. 5 (2014): 80–85.

Pallasmaa, Juhani; Mallgrave, Harry Francis; Robinson, Sara and Gallese, Vittorio. 'Architecture and Empathy'. *Finland: Tapio Wirkkala Rut Bryk Foundation*, 2015.

Picon, Antoine. *Digital Culture in Architecture: An Introduction for the Design Professions*. Basel: Birkhäuser, 2010.

Picon, Antoine. 'From Ownership to Authorship A Historical Perspective'. *AD Architectural Design Wiley* 86, no. 5 (2016): pp.36-41.

Yaneva, Albena. *Made by the Office for Metropolitan Architecture: An Ethnography of Design*. Rotterdam: 010 Publishers, 2009.

Yaneva Albena. 'Scaling Up and Down: Extraction Trials in Architectural Design'. *Social Studies of Science* 35, no. 6 (2005): 867–94.